Municipal Engineering

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Modern City Planning

By F. Brinkmann, Berlin, Germany

IN EVERY cultured country there is a remarkable interest in the art of city building, a movement which was started in Germany and where it is still stronger than elsewhere. It was therefore not surprising that in 1903 when the first exhibition of city building was held Dresden was chosen as its location, and a second one was held this summer in the German capital. In future years it is expected that other nations will follow this commendable practice. For centuries German cities have been powerful and influential in the commonwealth. Especially when with the foundation of the empire after the Franco-Prussian war, industry and trade developed in an unprecedented manner and people flocked in large numbers to the cities, which grew with surprising rapidity. And unlike France and Great Britain, where Paris and London are much more the capitals and centers of business, art, science, politics, etc., this growth of prosperity and of the population is noticeable throughout the empire and not alone in the industrial districts. We find very large communities in the North and South, in the West and East, some of them having risen to a population of about half a million. Hamburg, Munich, Dresden, Leipzig and Breslau can be compared only with the largest American cities. The rush from the open country was often so great and sudden that new problems were presented to municipalities. Now a particular science has developed during the last 12 years, that is the art of municipal architecture, which is now taught in all technical colleges.

The difficult problem is how we can accommodate the sudden increase in population within the old city limits and how land can be provided and utilized in a systematic and practical manner. Efforts were made to find such new territory but to preserve the old appearance and characteristic of the various towns. Building plans must not be designed according to geometrical rules, but in accordance with the exigencies of traffic and artistic considerations. In the two exhibitions a large number of models, plans and maps were placed on view demonstrating how the cities strive to combine old systems with new ones and to deal with the artistic, technical, social, sanitary and economical side of city building, and with the problem of transportation.

The building up of our communities chiefly on the Continent in Europe is the result of a conception that a ring encircles a town. The development follows a scheme which we may call the concentric plan. In other words a town grows by placing around the borders new rings or belts. This method has been our model for centuries and has found a firm place in our minds. The ring of the fortress, the walls and ditches, the tax belt where the citizens coming from the country had to pay an inland tax, the circular street and railway, they all have put a stamp upon the way of enlarging a city.

This has a harmful effect upon the economical political and traffic development of a community. Its place must be taken by a radial system, we must have rays instead of rings. This applies especially to the free spots still to be built up. These are the grave problems for any big city and Germany took the lead in realizing such projects by providing for a competition, called the "Wettbewerb fuer Gross Berlin." The foremost artists, city engineers, architects and social reformers have done their best to produce maps, sketches and models for a future Berlin. All these were placed on exhibition and were the center of attraction at the Berlin show. However, we are wrong if we think that these projects concern only the people

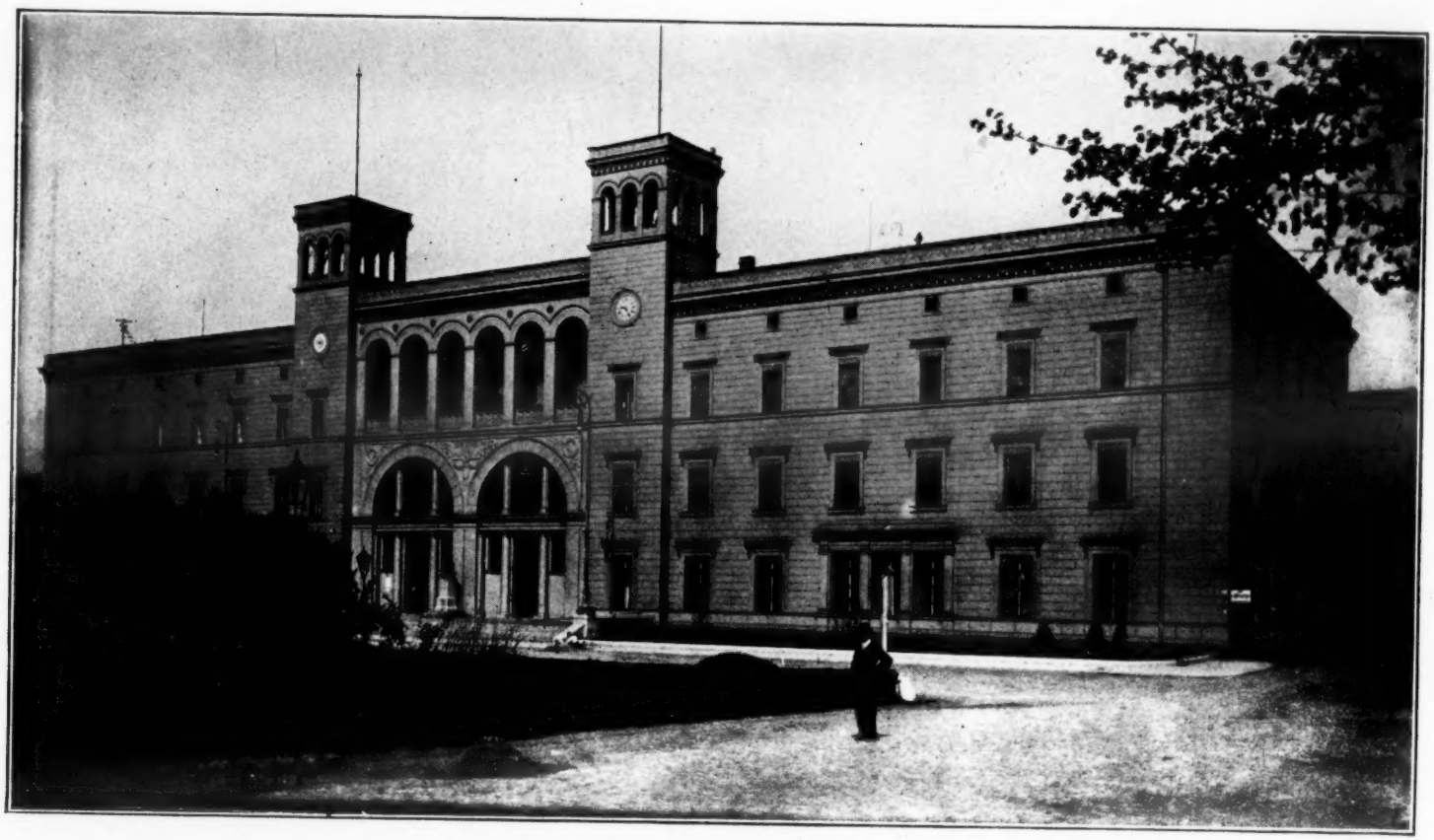
of Berlin and German citizens alone, for the lessons taken from that prize contest are very valuable for every large community abroad. We were therefore not surprised that numerous requests came from other German and foreign towns who wanted the exhibits loaned for a show of their own. They had to be refused except three, Dusseldorf, Antwerpen and London.

As we have seen before, a principal factor is the division of a large city into wedgelike portions, the main thoroughfares being straight, long and wide, emanating from the center as rays. These all shall have one or more kinds of railways. In nearly every town we observe that the largest returns come from such radial lines and that circular railways are operated with little or no profit. From the standpoint of a traffic expert as well as with respect to monumental structures, the entire city must form a unit with distinctive features in the case of Berlin, the capital.

All towns of the old world show an abundance of curved streets, which are a great hindrance to rapid transit. But even in the recently built outer districts or suburbs we constantly meet curved streets, for the reason that they produce a wonderful picturesque effect. Germany is especially rich with such quaint old crooked roads, the delight of the German citizen and of the cultured foreigner who comes every year to view our old historic spots. It is now the question how can we maintain the picturesque artistic character of the streets and yet comply with the requirements of sanitation and transportation. The practical Yankee, having no sense for beauty and art but rather for money, would say: "Pull down old sections and build the roads straight." This is indeed the simplest way, but the effect would be an ugly town, of which America has more than enough. The modern methods are best executed in Germany and I found excellent examples in the above expositions. The system of curved streets is now being replaced by that of straight thoroughfares, but to avoid a monotonous appearance, so common in the residential sections of London and American cities, the long row of houses must be interrupted by monumental buildings, statues, artistic lamp-posts, small parks and recreation grounds, and different treatment of the street crossings. Thus in viewing along such a modern road our eye does not get tired, for the scene changes constantly.

Another notable lesson can be learned from the German city builder in the matter of the width of thoroughfares. In Great Britain and most other countries they purchase ground just so much as at present is needed for traffic in the particular section. When the latter develops after 5 or 10 years they are forced to widen a road and purchase ground which has risen enormously in value. Besides, numerous buildings have to be pulled down to make room for the sideway, involving enormous costs. In Germany the town administration buys property for a street of such a large width as would be required after 20 to 50 years. Consequently when these districts are built up in the course of years and traffic has developed, the street is wide enough for its accommodation. People would say it is a waste to purchase superfluous ground in advance, but this is not the case, for that portion at present not used for a street or sidewalk is rented to the house owner to be used as front gardens. They are compelled to do this by law or they do not receive the concession to build their houses. Thus in most new sections of the German towns we see long alleys with pretty front gardens. When necessity arises all these or only a strip of them are removed and used for the new sidewalk, the old one having been turned into the widened street.

Much attention is given to a belt of forests and meadows for excursions, picnics, etc. A notable example is the Austrian capital with its wonderful natural surroundings, as we had a chance to see by maps, drawings and an immense model in the Berlin exhibition. Yet in Germany the Vienna example will not be entirely adopted, as those forests and parks make a perfectly closed geometrical ring, forming a drawback to transportation and to the extension of the city. We intend to have these green areas located at intervals around the community; intersecting the latter like a wedge in order to facilitate traffic and general development of the city. Berlin owns considerable areas of forests and large playing fields close to the city borders. The love of the German citizens for nature, especially for the forest, is well known, and in nearly every province exist so-called forest-protection leagues with thousands of members, who



BUILDING MUSEUM, BERLIN, GERMANY.
Exhibits of City Plans, Buildings and Municipal Matters.

arouse public interest to preserve their very precious forests. Much valuable work has been achieved by them and hundreds of acres of forest area has been saved. Railways and fine smooth country roads are laid through these surroundings, insuring good transportation and pleasant drives. Inside the towns the numerous parks and promenades receive full attention and compare well with the noted American parks, which in the Berlin show occupied a whole room. We were impressed by the pictures and sketches showing the play grounds, swimming and rowing ponds, reading rooms, drive ways and wading pools of the American system. The latter were adopted by the Berlin county council immediately after the close of the exhibition. We also had a chance to see the foremost universities of the United States with their beautiful surroundings, and we envied them for the immense space available to allow such a system of laying out the college buildings and campus park. In the old world space is scarce and the houses have to be built narrower and closer together with small areas for parks.

In the same way as the park system is most up-to-date in America, so the garden cities of Great Britain, which occupied a room in the last exposition, are most nearly ideal. Port Sunlight, Letchworth and others are too well known to need description. In the German empire the garden city idea has made its appearance in the last five years and Berlin can boast of having some wonderful suburbs of this kind. Dresden and the famous workmen colonies of the cannon king, Krupp in Essen, are other notable examples.

In the matter of transportation in all cultured countries very remarkable improvements have been made hand in hand with the development of traffic. Here Germany is again far in advance of any nation in the matter of safety and protection for passengers and employees. The signal system, guarding of road crossings, sanitary conditions of compartments, stations, workshops, old age and accident insurance are yet unsurpassed and stand most in contrast with the United States, where railways are operated only for money. Berlin owns a special railway museum, recently opened, where every one interested will find excellent material from which a lesson can be taken. From the various diagrams and statistics placed on view we noticed that underground local lines are only yielding a profit within the city limits. In the suburbs only street cars, elevated or level railways can be profitably worked.

Street Paving in New Orleans

By Martin Behrman, Mayor

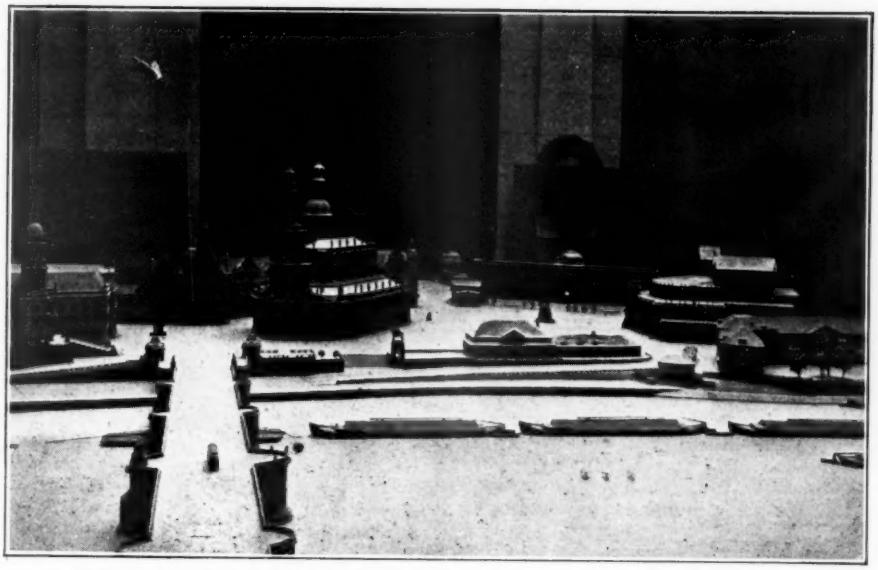
IN a paper by Martin Behrman, mayor of New Orleans, read before the League of American Municipalities, the street paving problem of that city is dealt with in a clear, concise manner. In the first of his paper Mr. Behrman comments on the slowness of New Orleans in the matter of paving her streets, and explains this tardiness by giving an account of the unusual conditions in levee construction, sewerage and water works problems, etc., that had to be met and overcome before the matter of street paving could be considered. A short abstract of the latter part of the paper is given herewith.

All the wide streets are subdivided so as to provide a neutral ground or parking strip at the center, a roadway on each side of same and a sidewalk on each side of the street. These parking strips vary from 20 to 100 feet in width, depending on the width of the street; the roadways, depending on the importance of the thoroughfare, from 18 to 35 feet in width; and the sidewalks from 10 to 20 feet in width.

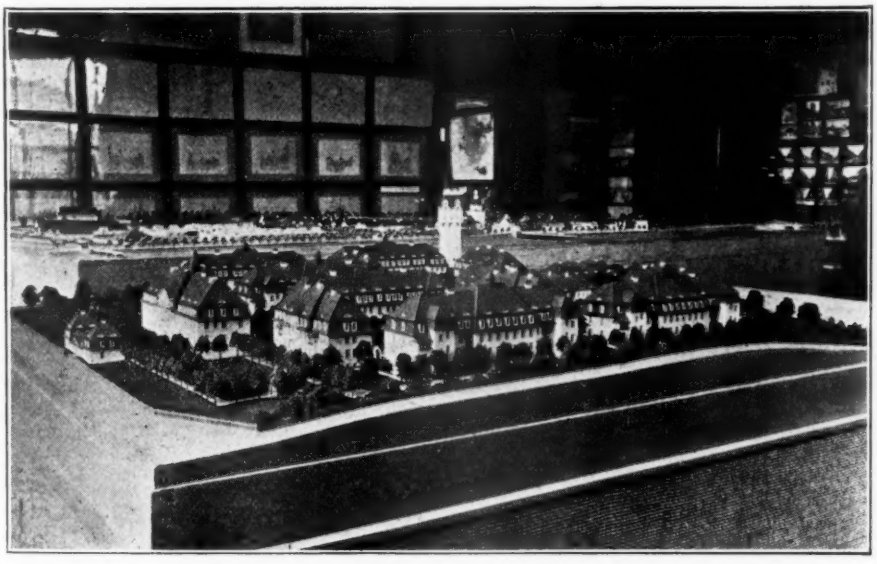
The paving of a street or construction of a sidewalk is brought about either by a petition of 52 per cent. or more of property frontage or by forced action of the City Council with a two-thirds vote. In either case the property owners have the right to designate the paving material.

In the case of original paving, whether the paving be petitioned for or ordered by the Council, the city bears the cost of paving street intersections and one-quarter of the roadway between street intersections.

In the case of repaving on petition of property owners, they bear the en-



MODEL OF THEATER PLACE ALONG ELBE RIVER, DRESDEN, GERMANY.



MODEL OF HOSPITAL BUCH, OWNED BY THE MUNICIPALITY OF BERLIN, GERMANY.

tire cost of the paving between the street intersections; but, if the repaving be ordered by the City Council, the city bears one-quarter of the cost of the paving between street intersections. In all cases the city bears the entire cost of paving or repaving street intersections and the entire cost of installing sub-surface drains.

The street railroad companies are required by their franchises to pay the cost of paving between their rails and for one foot outside of each rail. They are additionally obligated to maintain that part of the pavement throughout the term of the franchise.

In paying for the pavement the city engineer and street commissioner issue in favor of the contractor a bill against each property owner for his portion of the cost of paving, and the contractor must collect these bills. When recorded in the mortgage office these bills constitute a first lien on the property, superior to any mortgage or even vendor's lien.

The original pavements in the commercial district, laid in the early history of the city, were formed of square granite blocks, about 18 inches by 12 inches by 12 inches, laid on a 2-inch-thick cushion course of cinders, placed directly on the ground surface. This material was imported from European ports or from Maine. A few streets were at this time surfaced with 3-inch by 12-inch wood boards laid on ground sills. Some of the residential streets and the suburban roads were paved with oyster and lake shells, the latter being a species of clam. The shells were laid on 1-inch by 12-inch pecky-cypress boards to afford a good bearing because of the more or less soft and yielding character of the soil. Shell pavements usually consisted of a base course of 6 inches in thickness of oyster shells and surfaced with 6 inches in thickness of the lake shells. These made a very superior pavement, but so perishable as to require constant repair to keep them in good condition.

The first modern pavement—that is, asphalt—was laid on St. Charles avenue, a residential thoroughfare, in 1883, under a twenty-year maintenance, and cost $3.50 per square yard. A considerable portion of the asphalt wearing surface has worn out and has been renewed, but a portion of the original pavement is yet in service and in fairly good condition.

Shortly following the paving of St. Charles avenue a few other streets were paved with asphalt. About this time an active promoter introduced a form of concreting clay-gravel pavement, which was so much cheaper than asphalt and afforded so much satisfaction that it became popular, and a large number of streets were paved with it. But, like the shell roadways, the gravel pavements were perishable, and after a period of service worked into bad condition and became as unpopular as they had previously been popular.

Following this era of gravel paving, and for a few years thereafter, paving matters were almost at a standstill. The people did not seem to sufficiently realize the importance of modern pavement to be willing to pay for it. As a consequence the few streets that were paved from time to time were by forced action of the City Council, and oftentimes when the Council exercised its legal privilege in this direction there was very violent protest.

This condition of affairs no longer exists, nor has it existed for the past six years or more. The demand for pavement seems to be increasing. Although the Council meets twice each month, there is not a meeting but two or more paving petitions are filed. There are now about one hundred of these petitions on file, working their way through the necessary legal formalities of publication, etc.

During the past ten years 82 miles of streets have been paved or repaved at a cost of $6,384,138.27, of which the city paid for sub-surface drains and its portion of the paving $4,167,469.50. The net increase during the past ten years in street paving has been 67 miles, as the 15 miles forming the remaining portion of the 82 miles was repaving, which consisted in substituting modern for inferior pavement.

Contracts have just been made for five and one-half miles of street paving, which will cost approximately $544,000, of which the city will pay for sub-surface drains and its portion approximately $347,000.

The following is a list of the kinds and amounts of street pavements of New Orleans today:

Square granite block	28.95	Miles
Small granite block	4.14	"
Cobblestone	33.71	"
Shells	24.94	"
Gravel	36.45	"
Vitrified brick	10.10	"
Asphalt	70.08	"
Plank	38.60	"
Bitulithie	9.75	"
Granitoid	9.23	"
Mineral rubber	2.57	"
Total	268.52	"

There are approximately 525 miles of streets in the improved area of the city. Of these, as just stated, 268.52, just a little more than one-half the total, are paved. The forms of pavement most popular with the people are asphalt, bitulithic, granitoid, and mineral rubber, with small granite block in the commercial sections, where traffic is heavy both as to number of vehicles and tonnage per vehicle. Practically all of the vitrified brick pavements were laid about fifteen years ago. Only one street has been paved with that material during the past ten years.

The great number of asphalt streets and the question of their maintenance led to a discussion of the matter of a municipal repair plant. It was decided, after a consideration of conditions in Detroit and other cities, to install such a plant, with a view to making other improvements as well as repairs.

The city engineer very carefully investigated and studied the matter, and estimated what the repairs would annually cost if made by a municipally owned and operated plant; but before deciding to adopt that method, bids were asked for a contract to keep all the pavements on which the contract of maintenance had expired, or would expire during the contract period, in good order and condition for three years.

Two companies bid for this contract. The bid of the lowest was $114,500 for the first year, $40,000 for the second year and $40,000 for the third year, making a total of $194,500 for the three years. The great difference between the bid for the first year and the succeeding two years was due to the bad condition of the pavements and the very large amount of work necessary to put them in good order to commence with. The city engineer was confident that he could care for the pavements for a much less cost than the amount of the lowest bid, and decided to build a plant.

The city owned half a square of ground at a point constituting an ideal site. This site was situated on the bank of one of the two navigation canals, and possessed railroad-switch-track connections, thereby making the delivery of materials both convenient and economical. The erection of a stationary plant was contracted for, to be inclosed in a brick building, and having a capacity of 1,200 square yards of wearing surface per day of ten hours' work. The cost of this plant was $16,862.50.

The city engineer purchased the necessary materials and employed the required labor and erected all the buildings incidental to the plant. The plant, including rolling stock, live stock and all tools and equipment, both at the plant and for street work, originally cost $66,008.82, since which $11,193.66 has been expended for additions and improvements, so that to-day the plant represents a total expenditure of $77,202.48, exclusive of the site. The plant is equipped with a very complete laboratory for testing all kinds of building materials, including a rattler for testing the abrasive strength of brick and stone, and with an electric stone crusher.

The street paving contracts provide that all old materials in the way of curbstones, paving stones and iron not required in the execution of the contract shall be delivered by the contractor to the municipal repair plant. These old materials, which amount to thousands of dollars in value each year, formerly went to the contractor, who rarely made fair allowance for their value in his bid; but the plant has had the advantage of having them without cost for use in the work it has done.

About seven months were consumed in constructing and equipping the plant. It was put in operation on the 1st of September, 1906, at which time there were 352,302 square yards of asphalt pavement to maintain. To-day about 641,000 square yards are maintained.

Based on the total square yards to be taken care of, the average cost per square yard for materials and labor for the first year's repairs was 11.44 cents; for the second year, 7.8 cents, and for the third year, 5.74 cents. Each year the cost for labor and materials was less than the bids stated. For the three years the cost of labor and materials, including all fixed charges and cost of repairs and renewals, was $93,165.62, which was $101,334.38 less than the $194,500 which would have been paid for the same work under the bid. The plant has constructed new asphalt pavement in a number of street intersections, in several alleys and in front of several markets and other public buildings, where the city bore the entire cost of the work. All asphalt pavements are worked over each month, and are, therefore, at all times, in good condition; and where pavements show signs of early disintegration, the repairs are made before the break occurs.

The efficient manner in which New

Orleans cares for and maintains her paved streets, and the progress made in the last few years, indicate that much may be expected in that line before 1915, when New Orleans hopes to hold the Panama World's Fair.

Problems of Milwaukee's New Administration

THE statement was made at the convention of the League of American Municipalities, held in St. Paul in August, 1910, that Milwaukee, under her socialistic administration, was receiving a great deal of credit for doing something entirely new, when in reality she was going over old ground and not showing much progress in that. Such a statement hardly seems justifiable in the light of what has been accomplished.

The conditions in Milwaukee when the socialists set to work, were, to say the least, discouraging. The system of public accounting had been so handled that money was taken from current appropriations to take care of back deficit. The city had been spending more than its revenue, and then covering the deficiency by using the proceeds of bonds issued for other purposes. As a consequence there was impending an annual deficit of $200,000. Moreover, the new administration could borrow very little money, because of the fact that the city's debt was already close to the legal limit, and the tax rate was fixed by law so as to be unchangeable. These were the conditions which have perhaps made progress slow in Milwaukee.

It is true that the ideas set forth in the platform upon which Mayor Seidel was elected, were not radically different. They are briefly:

Home rule.

Public ownership of public utilities.

A municipal terminal and municipal wharves.

Equal and just taxation.

Public slaughterhouses, public markets, public cold storage.

Public improvements by the city; no contract system.

Municipal quarry, wood and coal yards, work for the unemployed.

Extension of the city limits, sanitary homes, factories and schools, play grounds for children.

Dispensaries, four hospitals.

Public comfort stations.

Sewage and garbage disposal.

Small parks, shade trees, the abolition of slum neighborhoods, a municipal lodging house to abate the tramp nuisance.

School extensions, free text books, ters.

Fair treatment for all city employees, no dismissals without public trial.

In the method of obtaining these free concerts in the parks, social centhings, and in the ideas underlying them, will be found the new idea the socialists hold.

First of all they set about doing away with the spoils system of office holding. Those offices which had been mere sinecures were abolished. Offices were combined where the duties were similar and light, and departments were so rearranged that a combination of duties might be more conveniently made. The mayor's body guard was sent out to patrol duty, and it was made plainly evident that the city demanded efficiency in all departments.

Those things which have been accomplished in the five months of the present administration, may be briefly summarized as follows:

Health department has proven typhoid epidemic due to bad water, a condition previously denied and neglected. Prompt measures for permanent purification taken.

Tentative understanding reached to issue no more bonds for city maintenance, or running expenses, but for permanent improvements and land only.

Plans are under way and a tract selected for the site of first municipally owned workingmen's homes.

Public works department reorganized on efficiency basis. Experts placed in charge of the various departments of the board of public works.

Twenty-four hours off every fifteen days granted to policemen, over protests of the chief.

Reorganization of accounting system in comptroller's office under way.

Shiftless and incompetent work in street paving stopped by the mayor after personal inspection.

New park selected.

Decision by park board to investigate foodstuffs and drinks sold in parks, to shut out all impure products.

City treasurer redeemed bonds before maturity, saving interest to city.

City attorney brought old suits into court, winning for city a number involving damages. Halted practice of "agreements" and "friendly suits."

City attorney has begun action to recover $72,000 from street car company, which has been accumulating in unpaid license fees during ten years. Action begun for better car service, several ordinances now pending; also for cross-town car lines, a vital need, ordinances granting franchises to force company to run cars pending in council.

City attorney won case against St. Paul road before railroad commission for track depression, commissioner giving decision from bench without argument.

Council appropriated money to install unit system of cost keeping, which will put Milwaukee in lead of all American cities in this respect. City will bid on all public work, doing away with contracts.

With reference to the changes in the comptroller's office, it may be noted that under the old system no regular reports were called for. Obsolete filing systems were in use and no check nor inventory was to be had of office fixtures, supplies, etc., in any department. A regular system of reports is now enforced and an entirely new system of departmental accounting is being installed. All complaints are received and attended to either by form letter, personal letter, or personal inspection as the case may demand. The members of the council and the administration are closely in touch with every department and a regular system of reports keeps them informed on all current matters. The sum of $5,000 has been appropriated to install a cost keeping system under expert supervision. This system is intended to cover all classes of public work and has for its object the abolition of excessive profits, and poor material; for it is intended that the materials shall be tested up to the required standard as shown by the known costs of material asked for. The ultimate aim is, of course, public improvement under the day labor system.

The statement that Milwaukee has made little progress in carrying out her plans may perhaps be granted; but in view of the difficulties encountered and the change from the old established customs, it must be conceded that much has been done. The five months under a socialist mayor have at any rate served to lay the foundation for a future advancement that may mean a great deal to other municipalities as well as to Milwaukee.

Wooden Block Pavement Tests in Minneapolis, Minn.

By D. M. Avey, Indianapolis, Ind.

THE great number of failures recorded against wood block pavements previous to 1906 led to a discussion concerning the merits of such paving and a desire for a decisive test of its real value. In accordance with this desire a cooperative comparative test was undertaken by the Forest Service of the U. S. Department of Agriculture, the city of Minneapolis, the Kettle River Quarries Co. of Minneapolis, and the Republic Creosoting Co. of Indianapolis. The pavement was built in July, 1906.

By the terms of the agreement between the above mentioned parties, the division of responsibility was made as follows: The Forest Service furnished about fifteen thousand (15,000) feet of the requisite sizes of white birch, western larch, jack pine, red fir and hemlock lumber; the Kettle River Quarries Co. manufactured, furnished the oil, and treated the first three varieties, and the Republic Creosoting Co. did the same with the last two and also the southern pine, Norway pine and tamarack, on regular contract. The city of Minneapolis prepared the foundation, put in the concrete base, laid the blocks and completed the details of the paving, furnished records as to cost, sprinkling, cleaning, etc., and takes traffic records twice a month.

The method of laying the blocks is shown by the accompanying diagram, the numbers referring to the locations and kinds of blocks as described in the statement given in the following description:

1. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil per cubic foot.
2. Tamarac, 6 and 8-inch blocks, 16.2 pounds of oil per cubic foot.
3. White birch, 6 and 8-inch blocks, 22.1 pounds of oil.
4. White birch, 4 and 6-inch blocks, 22.1 pounds of oil.

Classes 3 and 4 are laid each on one-half the width of the street.

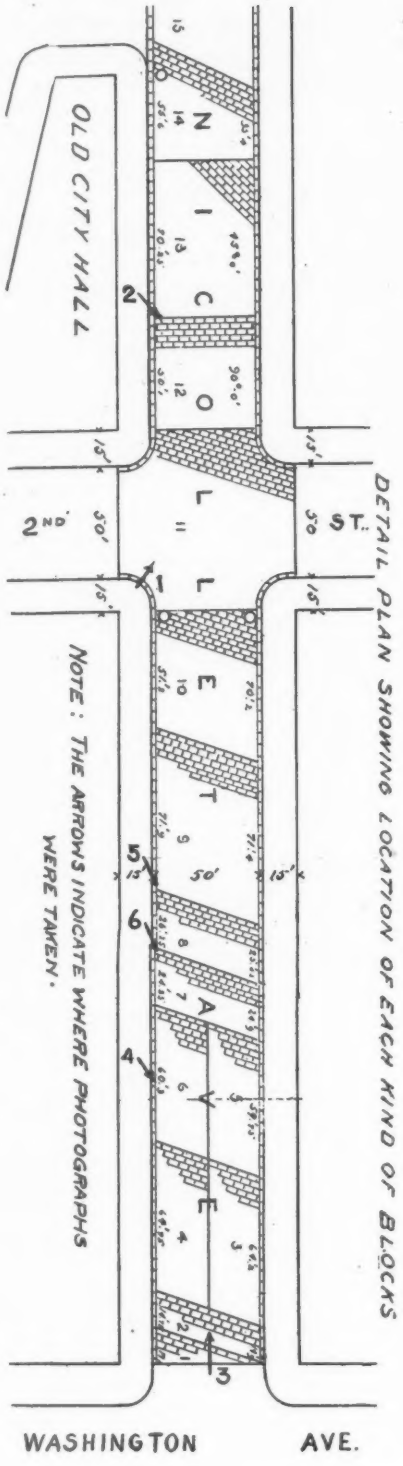
5. Western larch, 4-inch blocks 20.4 pounds of oil.
6. Western larch, 5 and 8-inch blocks, 20.4 pounds of oil.

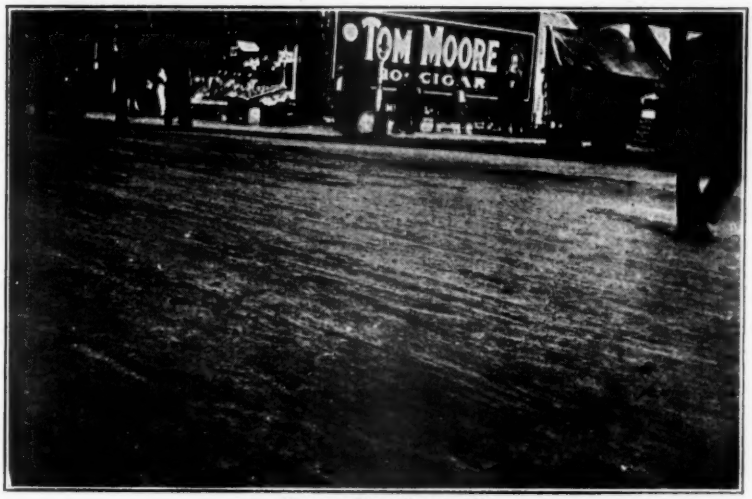
Classes 5 and 6 are laid each one-half the width of the street.

7. Red fir, 6 and 8-inch blocks of fine grained wood, treated with 15.8 pounds of oil per cubic foot.
8. Red fir, 4, 6, 8 and 10-inch blocks of coarse grained wood, 15.8 pounds of oil.
9. Southern pine, 6 and 8-inch blocks, 18.5 pounds of oil.
10. Hemlock, 4, 6 and 8-inch blocks, 15.5 pounds of oil.
11. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil, this section being the intersection of Nicollet avenue and Second street.
12. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil, laid with courses perpendicular to the curb.
13. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil, laid with courses at angle of 45 degrees with curb.
14. Tamarac, 6 and 8-inch blocks, 16.2 pounds of oil.
15. Norway pine, 6, 8 and 10-inch blocks, 16 pounds of oil.

A further description of the starting of the experiment will be found in MUNICIPAL ENGINEERING, vol. xxxiv, page 14, to which reference may be made for details of construction. The most careful workmanship and the best of materials were employed.

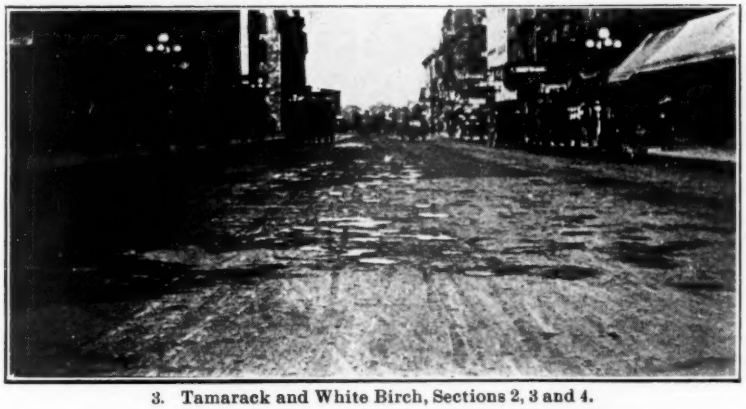
An inspection of the pavement on August 21, 1910, shows that some comparison may be made at this time, though more definite results may be attained by a continuance of the test. In making the comparison it must be noted that the section to the right of the diagram was subjected to much the heaviest traffic, for, in addition to the heavy haul from First street to Washington avenue, due to drayage from the railroad, there are three stone companies located so that all of their loaded four-horse wagons delivering material must follow along Nicollet avenue from First street to Washington avenue. A comparison will be attempted in the following or-


OLD CITY HALL
NICOLLET
2ND ST.
NOTE: THE ARROWS INDICATE WHERE PHOTOGRAPHS WERE TAKEN.
DETAIL PLAN SHOWING LOCATION OF EACH KIND OF BLOCKS
WASHINGTON AVE.



1. Norway Pine, Section 11.

2. Norway Pine, Section 12.



3. Tamarack and White Birch, Sections 2, 3 and 4.

MINNEPAPOLIS EXPERIMENTAL WOOD PAVEMENT.

der: The kind of wood; the size of blocks; the grain of the wood, fine or coarse; and the manner of laying. It will be noted that all the blocks were laid with the grain vertical, and the joints were filled with pitch. The roadway is 50 feet wide and has a crown of 8 inches.

With regard to the best kind of wood for wood block pavement, Norway pine seems to show the most uniform wear. In the diagram, sections 1, 11, 12 and 13 are of Norway pine and they are without doubt in the best state of preservation. Section 11 in particular is in excellent condition, even though exposed to the double traffic along Nicollet avenue, and also along Second street; though that along Second street is not excessive. Two photographs show the excellent condition of the Norway pine at the present time. No. 1 showing section 11 and No. 2 showing section 12. In point of value for paving the other woods are in the following order, judged by their present condition:

Southern pine and tamarack show very little difference and perhaps might be rated nearly on a par, as neither kind of wood shows evidence of much pitting. Photograph No. 3 shows the tamarack of section 2, being that portion nearest the camera anl up to where the first hollows are shown.

Hemlock shows very little inferiority to the two last mentioned woods, though a comparison made between section 10 (hemlock) and section 9 (southern pine) shows points in favor of the southern pine. In this case as the two sections adjoin each other, the conditions of wear may be assumed to be identical.

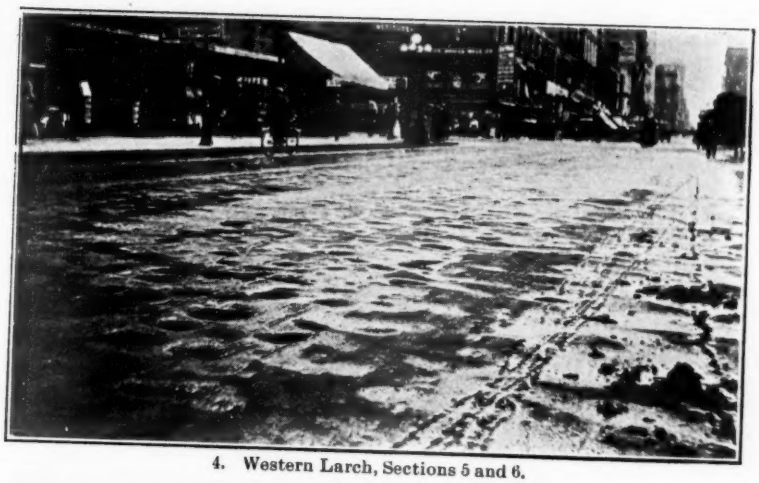
The other three woods take fourth, fifth and sixth places in point of preservation and uniform wear, as follows: White birch, western larch and red fir. The last named wood, red fir, is in a very bad state at the present time; hollows to the depth of 3 or 4 inches and of 2 or more square feet are noted, while in at least one instance it has apparently been necessary to patch the surface with new blocks. Photograph No. 4 shows the western larch. Nos. 5 and 6 indicate the condition of the surface of the red fir. Photograph No. 3 shows the white birch, sections 3 and 4, in the background, beginning with the hollows showing in the surface.

As for the question of the size of blocks best adapted to wood block paving, a mere inspection of the test pavement at this time does not warrant a decision. Section 3, of 6- and 8-inch white birch blocks is in better condition so far as uniformity of wear is concerned than is section 4, of 4- and 6-inch white birch blocks. They are shown in photograph No. 3 in the background, section 3 being on the right half of the street. But on the other hand, section 5, of 4-inch western larch, is much better than section 6, of 6 and 8-inch blocks. Section 5 is on the farther side of the street and section 6 on the nearer side, in photograph No. 4. From this it may be assumed that the difference of wear is due to the heavier traffic over sections 4 and 6 rather than to any influence of the size of block.

Sections 7 and 8 illustrate the difference in value between fine grained and coarse grained woods in the case of red fir. In this case the two sections adjoin so that the traffic conditions must necessarily have been identical, but section 8 (shown in photograph No. 5) is in much better condition than section 7 (shown in photograph No. 6). The fine grained fir in this case shows deeper and larger hollows than the coarse grained wood of the same variety, and it was noted that it has apparently been necessary to patch the former.

With regard to the manner of laying, that is, the angle at which the courses are laid, it would seem that more time is necessary to determine fully the best procedure. In the case of the Norway pine, section 11, which was laid with the courses at an angle of 67 degrees and 30 minutes with the curb, it seemed to be in better condition than section 12, which was identical in every particular, except in the angle of courses, which in this case was 90 degrees. But on the other angle of courses, which in this case was 90 degrees. But on the other hand section 13, laid at 45 degrees was not as good as section 12 and hardly to be compared at all with section 11. A comparison of photographs No. 1 (section 11) and No. 2 (section 12) will illustrate the superiority of section 11. If the final results of the test are what the present condition would indicate, it would seem that an angle approximating 67 degrees and 30 minutes was the happy medium to be sought.

The purpose of this article is not to set forth the results as being demonstrated by this test thus far, but rather to offer a report of its progress, and it is hoped, an indication



4. Western Larch, Sections 5 and 6.

5. Red Fir, Section 8.

6. Red Fir, Section 7.

MINNEAPOLIS EXPERIMENTAL WOOD PAVEMENT.

of its value. The final results, when anonunced through the medium of the Forestry Department are certain to be of value in determining the fate and future of these kinds of wood as paving materials.

Work Preliminary to Road Construction and Street Pavement Maintenance*

By George C. Warren, Boston, Mass.

I PROPOSE to show that the success or failure of a pavement is fully as likely to depend upon causes beyond the contractor's control, both preliminary to the construction of the pavement and subsequent to its completion, as upon perfect or faulty workmanship or materials; although, when a pavement fails to sustain traffic, the public universally, and officials generally, attribute the result to a combination of inefficiency and poor material, for which the contractor is held responsible.

At the outset I believe we shall agree that water is the great enemy of pavements, and the most common cause of their undoing, even when blocks of sandstone or other comparatively soft stone are used. The only material that is not seriously injured by the destructive influence of excessive water is granite and even that is injuriously affected.

The sources of deterioration from water may be summarized as follows:

(a) Improper sub-drainage.
(b) Excessive sprinkling or flushing.
(c) Lack of efficient cleaning.
(d) Sub-drainage, due to the absence of pavements, or to their improper construction, between and around railroad tracks.
(e) Too flat crown or grade to provide proper surface drainage.

All of these features are absolutely beyond the control of the contractor, yet they provide most fruitful sources of dispute between him and municipalities as to the responsibility for defects which develop subsequent to the expiration as well as during the maintenance periods of paving contracts.

A discussion of each of these features will be useful.

Sub-Drainage. Perhaps there is no part of street pavement construction which is given so little intelligent consideration by engineers, or in which local custom is so blindly followed from decade to decade, as this matter of sub-drainage. And yet practically every writer on street pavement construction from John MacAdam to the present day has referred to sub-drainage as the first essential to successful road or pavement construction. We find cities where the prevailing sub-soil is clay, that affords inadequate natural drainage, providing no artificial drainage for their pavements. We find other cities where the sub-soil is either sand or gravel, that affords the best possible natural drainage, providing for their pavements elaborate systems of sub-drainage that are of course wholly unnecessary. Again, we find cities adopting systems of sub-drainage in use in other cities where the sub-soil, and, consequently, the artificial drainage requirements, are radically different.

Several years ago I learned of a most glaring example of this copying process, which illustrated perfectly the lack of application of ordinary engineering, not to say "horse" sense in pavement drainage. The municipal authorities of a lake city built on sand dunes, and having few manufacturing industries or railroads, evidently feared that the local engineers were not competent to prepare the plans and specifications for expensive paving work, so they engaged for the purpose a consulting engineer from Chicago. He practically copied the standard plans and specifications of the City of Chicago. It is well known that the prevailing soil in Chicago is clay, and that the railroads and factories of the city provide large quantities of cinders, which serve the purpose of an excellent cheap filling for sub-drainage purposes. In copying the Chicago specifications, in general, the engineer included the drainage specifications, which called for soft tile below the curb, and filling of cinders around the tile and to the

*A paper before the American Society of Engineering Contractors.

bottom of the curb. The result was a very elaborate and expensive artificial drain system, wholly unadapted to the conditions, that had to be met. The specification provided for cinders, which had to be carried over two hundred miles by rail to be used in the place of the sand upon which the city stood, and which at no expense, would supply the best possible natural drainage to be procured. Evidently the engineer in this case gave absolutely no consideration to local conditions, but blindly copied and adapted what had been found good for Chicago.

As a general rule, however, the fault with drainage is due to the fact that no artificial sub-drainage is proveded, when the natural drainage conditions are wholly inadequate. In such cases, the under side of the pavement is always damp, and the inevitable result is deterioration, and a tendency of the pavement to settle from its normal shape and grade.

In a certain city of Central New York, which I have had especial opportunity of studying during the past twenty-four years, the pavements have proved to be better than those in any other city of the United States or Canada which I have visited, although the sub-soil is generally clay, the poorest medium for natural drainage. Apart from careful construction and selection of material used in the pavement, which have not been greater than the care shown in similar work in other cities where the results have been far less satisfactory, I attribute the unusual excellence of these pavements chiefly to the elimination of water, both from the under and upper surfaces. This has been accomplished:

First. By an efficient system of sub-drainage; and

Second. By thorough dry cleaning and entire absence of wetting down the dirt by excessive street sprinkling and flushing.

The system of sub-drainage in this case, which was adopted in the year 1886 and has been strictly adhered to since, is as follows:

(1) A trench 1 foot wide is excavated under the curb to a depth of 3 feet below the top, or 18 inches below the bottom of the curb.

(2) In the bottom of the trench is placed a narrow culled hemlock board, for which other cheap lumber may be substituted, and the pavement side of the trench is boarded up with the same material, up to the bottom of the curb, to prevent the earth under the pavement, as it dries, from falling into the drain.

(3) On the board in the bottom of the trench is placed a line of three inch half round porous tile open at the bottom and with open joints.

(4) Over the tile the trench is filled to within two inches of the bottom of the curb with hand placed field or cobble stone, over which is spread a thin course of finely crushed stone, slate shale, or slag, fine enough to fill the chinks in the field stone at the surface but coarse enough not to run into and fill the spaces between the pieces of field stone.

(5) Over this is spread about an inch of loam or clay (not gravel or sand), which, when dry will hold together and not sift into the drain.

(6) Over this curb is set in the usual way. If the curb is of stone, it is bedded in either gravel or concrete; and if the curb or gutter is of Wainwright or other Portland cement, it is laid directly over the drain. Of course the drains are connected with catch basins.

This method of construction is the best, most efficient, and most economical system of sub-drainage I have ever known. No cross drains have been necessary, although the natural drainage conditions are very poor.

Systems of surface drainage of which I thoroughly disapprove, either because of inefficiency or unnecessary expense are those that include:

(a) Too shallow drains at the curb; and

(b) Trenches filled with crushed stone in the center of the road with similar cross drains at intervals.

The cross drains tend to attract water from outside the roadway and carry it under and to the center of the pavement, where it percolates into the otherwise dry sub-soil. This is not only an unnecessarily expensive system of sub-drainage, but one that is really less efficient than no drainage.

It may be set down as a fact that with any of the modern, nearly waterproof forms of pavement now in vogue, unless there are actual springs under the roadway (an extraordinary condition that requires extraordinary treatment), the sub-soil under the pavement will be practically bone-dry if no water is allowed to percolate from back of the curb. To prevent this a drain having a depth of three feet below the curb is all that is necessary. As indicated above, if the sub-soil is gravel or sand, providing natural drainage, through which water percolates, no artificial drainage is necessary.

The most frequent causes of failure

in pavement construction, all of them being entirely under the control of city officials, and just as entirely out of the control of the contractor, are as follows:

First. Inefficient or no drainage. This we have considered above in considerable detail.

Second. Improper back-filling of trenches.

Third. Insufficient crown and gutter grade to carry off water and prevent pools standing near the center and in the gutters of the roadway.*

Fourth. Lack of cleanliness.

Fifth. Excessive flushing or sprinkling of streets.

Sixth. Inadequate pavements, or none at all, between and along railroad tracks.

These faults are of such importance as to warrant careful consideration. They directly affect pavement maintenance and guarantee from both practical and legal points of view and are not second in importance or cause of trouble to even poor workmanship and materials employed in the construction of the pavement.

The two seriously objectionable practices, lack of cleanliness and excessive watering of street pavement surfaces, generally go together because;

First. If the street surface is not clean, wetting is necessary to allay the dust, and in this way mud is formed; and

Second. If the dust is converted into mud, the mud can be removed from the surface of the road only by the use of an excessive quantity of water, under such high pressure as to damage the pavement.

Recognizing that water is the enemy of all pavement surfaces, the effort of those engaged in the improvement of road surfacing material of every kind is directed toward reducing the porosity of the roadway surfaces, and otherwise protecting them from the ravages of excessive wetting.

On the other hand, the efforts of some street cleaning interests are directed toward keeping the streets wet by various forms of sprinkling and flushing machines, without properly cleaning the surface of the pavements. Still other interests engaged in street cleaning advocate dry cleaning and are developing methods to accomplish their purpose. Their objects are feasible, but, pending the advent of machines that will efficiently and economically do the work, all municipalities should take a middle ground, and follow one of the following courses:

(a) Thoroughly wash the pavements nightly, without pressure, using either a washing machine or fire hose, and immediately follow the washing with hand squeegees to remove all excess of water from the gutters and slight depressions.

(b) Sweep nightly with machines, lightly sprinkling the pavement in advance of the sweeper, and using enough water to lay the dust but not enough to convert it into mud, exactly as a dirty floor is cleaned by light sprinkling and hand sweeping.

No one would think of wetting a floor to such an extent as to convert the dust into mud, and then expect to remove the mud by sweeping. Yet the equivalent of this is done in most cities where the attempt is made to clean the pavements by rotary brooms immediately following a thorough wetting by sprinkling wagons. After such an operation is it any wonder that, covered with water and earth or sand (a mixture that will sharpen and wear away the hardest steel), pavement surfaces are literally butchered by the grinding they receive from the wheels of the traffic?

Either of these methods specified, if carefully and properly applied, will provide a well-cleaned pavement surface which will require no sprinkling through the day, if hand cleaned by patrol system by day. The adoption of such a system will insure a pavement that will always be in the best condition for horses, automobiles, as well as pedestrians on the sidewalks, being free from dust and mud, and capable of sustaining traffic without deterioration.

Track Construction. Railroad beds improperly constructed, or tracks poorly laid, are common sources of injury to pavements, and the damage will extend not for only a few feet from the rails, but sometimes across the entire width of road bed. The same undesirable results are often produced by faulty construction in the pavement itself between and along the rails. If the rails or the ties are not so securely laid as to prevent vibration, the pavement, whatever may be its construction or the material used, will be sure to break and allow water to work its way

*"Back-filling of Trenches" and "Pavement Crowns" have been subjects of papers prepared by Mr. George C. Warren for the convention of the American Society of Municipal Improvements, copies of which may be obtained by addressing Mr. Warren, 59 Temple Place, Boston, Mass. They may also be found in MUNICIPAL ENGINEERING, vol. xxxiv, p. 21, and vol. xxxviii, p. 88.

through and settle beneath the pavement. I have seen, in a number of cities, first class pavements laid outside the track area, from the rail to curb, or from within two feet of the rail to the curb, while between and around the rails there would be absolutely no pavement at all. In such cases from one to three inches of water will accumulate between the tracks during every heavy rainfall or spring thaw, and have no outlet except into and under the pavement; and if the pavement is not more or less destroyed it is only because Nature has provided conditions which permit the water to drain nearly vertically into and through the soil.

Maintenance Guarantees. Turning more specifically to the subject of pavement guarantees and maintenance, I am firmly of the opinion that pavement guarantees extending beyond a term of one year, which is ample to test the integrity of material and construction, are against the best interests of the taxpayers. In support of this view, I offer the following reasons:

First. Guarantees are always of doubtful legality. On assessment work, which is the basis of payment for over 75 per cent of the street pavements laid in the United States and Canada, the courts have frequently, if not generally declared maintenance guarantees to be illegal, because they provide for indirectly assessing abutting taxpayers for the cost of maintenance, which city charters usually say shall be paid for by the city at large.

Second. There is always likely to be more or less dispute between the contractor and the city regarding the contractor's obligations to make certain repairs, especially when the damage done can even remotely be attributed to causes such as these to which we have referred as lying outside the jurisdiction of the contractor, and, similar contentions will arise between the contractor and the city as to the extent of repairs and nicety of condition of maintenance of the pavement which is proper under guarantee. It is not an exaggeration to say that under guarantees, cities generally endeavor to require contractors to make repairs to pavement surfaces that they would not think of making at the expense of the city.

Third. When guarantees for maintenance are required, prudent, conservative contractors always include in their bids the interest on the cash retained, and the cost of the surety company bond premiums required by the city, and a sufficient amount to cover a conservative estimate of maintenance charges. It has been calculated that if surety company bonds for five years maintenance were required on all pavements laid in the United States and Canada, the premium, always added to the contractor's bid, would each year amount to more than a million dollars.

It has been suggested that in lieu of surety company bonds for guarantee the cities retain 5 per cent of the contract price. If this were generally adopted the cash retained by the cities would aggregate approximately $5,000,000.00 annually, and the interest alone on the accumulation of five-year guarantee periods would amount to $1,500,000.00. This bond premium, or interest, contractors must add to their prices when the cost of labor and materials advance. Generally speaking, contractors, regardless of the estimated cost of maintenance, will add to what would otherwise be their contract prices the full amount retained by the city. Few contractors are sufficiently strong financially to have their capital tied up, even when it is drawing interest. Such a system would drive the comparatively small, but reliable, contractors out of business, and leave the field in possession of concerns that are financially strong enough to carry or negotiate for carrying the amount of money retained by the cities.

Fourth. Maintenance guarantees tend to produce lax inspection, or the loss of control of construction by the proper city officials, as the contractor, in case of dispute or disagreement as to the methods of construction, will notify the city officials that if he is not permitted to do the work in the way he thinks best he will not be responsible for the guarantee.

Fifth. Maintenance guarantees encourage the acceptance of proposals from incompetent or inexperienced contractors, and the selection of pavements of doubtful desirability. How often do we hear the statement made in connection with the awarding of street pavement contracts, "The contractor may not be reliable, or the pavement may not be successful, but we have the surety company bond, or the cash retained to back the five-year guarantee."

In twenty-five years' experience in the street paving business I have seen many paving contract guarantees defaulted, but I have never seen a pavement made good through a guarantee bond or a cash retainer, when the pave-

ment or the contractor failed, or when it was against the business interests of the contractor "to make good." There may be such cases, but if there are, they are usually the "exception which proves the rule."

Finally the best interest of the city in the construction of pavements will be conserved, as it is in all other classes of construction, by the adoption of the following policy:

(a) Decide upon the form of construction best suited for each particular case.

(b) Prepare careful plans and specifications for the work, and give the construction the closest and best expert inspection and supervision.

(c) Take entire responsibility for the results. In the long run this policy will produce better pavements and at lower costs, than will the apparently attractive, but misleading, maintenance guarantee system.

The Beargrass Intercepting Sewer, Louisville, Ky.

NO QUALITY of modern engineering is more marked than the very great attention now given by the best men to the most careful study of future growth that must be provided for in all adequate public works. In these constructions, as in the mechanical equipment of the industries, growth of population or of market constantly call for better facilities. Machines can pretty easily be scrapped, but an inadequate sewerage system, so planned that it must be utterly discarded, is a more serious loss; its scrap value is a vanishing quantity.

The sewerage work at Louisville, Ky., furnishes an interesting example both of an outgrown, and almost valueless main sewer system, and of very careful planning for the growth of the city in designing of the new system under construction. An instructive example of adequate study of future needs, and provisions for them is given in the report of J. B. F. Breed, chief engineer, and Harrison P. Eddy, of Boston, consulting engineer of the Louisville work. The particular case is that of the sewer known as the Beargrass Intercepter.

The sewerage from about 7,829 acres, or twelve and one-fourth square miles, will be discharged into the intercepter. In determining upon the quantity of sewage to be provided for by the intercepter, the tributary area was divided into districts of three classes, residential, manufacturing and mercantile. After a very careful study of the topography and other conditions which will affect the nature of the development of the city, it was decided that it was reasonable to expect that 7,141 acres would be devoted to residential, 622 acres to manufacturing and 66 acres to mercantile districts. In the computations upon which sizes were based it was assumed that the quantity of sewage from the residential district would average 100 gallons per person per twenty-four hours.

To this quantity was added 1,960 gallons per acre per twenty-four hours as an allowance for unavoidable leakage of ground water into the sewers. From the manufacturing district it was estimated that provisions should be made for 24,000 gallons per acre for twenty-four hours, with the above allowance for ground water leakage. In the residential districts tributary to the Northwestern Trunk and Middle Fork Sewers, the estimated future population was 25 persons per acre, while in the remainder of the residential territory an allowance was made for 40 persons per acre.

Provision has thus been made for very much larger quantities of sewage than will be discharged from the trunk sewers for many years to come, in fact, the population of that portion of the city tributary to the intercepter at the time when it is developed to the extent assumed in these calculations will be 230,000 people and the population of the whole city will be close to 1,000,000. Where is a corresponding surplus of capacity in the manufacturing and mercantile districts.

Garbage Collection and Disposal in Minneapolis, Minn.

Editorial Correspondence

MINNEAPOLIS has a system of garbage collection and handling that is entirely free from nuisance. The garbage wagons as they pass along the street do not give off the customary odor that one is accustomed to expect; and at the transfer station there is not the nuisance common to such.

Each householder provides two cans of a size specified by the rules of the department. In one of these is deposited all ash, glass and like incombustible matter. In the other the common kitchen garbage is placed after being carefully drained of all water and wrapped in paper. This rule of drainage and wrapping is rigidly enforced. To the method of handling the wet garbage above described may be attributed the cleanliness of the wagons, and the sanitary conditions of the transfer and incinerating stations. The frozen garbage can and the half putrescent mass of garbage are entirely unknown in Minneapolis; and even in the summer time it is not necessary to collect more frequently than once each week.

The garbage is collected in two-ton, steel, covered wagons, of which there are thirty in service on regular routes. These wagons carry the garbage to the transfer station, where the wagon boxes are lifted off the trucks and placed on flat cars, to be conveyed to the incinerator. The accompanying photograph shows the method of handling at the transfer station. The average haul of the wagons is slightly over three miles. All trouble, complaints, special service calls, etc., are handled by a clerk in charge of the transfer station; and a regular card system of complaints is in use, giving the complaint, the testimony of the driver, and, in fact, all data needed in connection with each complaint. Failure to comply with the rules of the department results in the non-collection of the garbage, and a reporting of the delinquent party to the transfer clerk. Then if the person whose garbage has been passed should phone to make a complaint, a reference to the card of complainant shows at once why the can has been passed. This system further serves as a check upon the driver, who must show good reason for neglecting to gather garbage about which complaint is made.

DISPOSAL.

After being taken to the plant on flat cars, the wagon boxes are lifted by a three-motor crane, which conveys them into the building and dumps them into the charging hoppers. This carrier system is shown in an accompanying photograph. The three-motor crane permits of the back of the box being elevated as the front is lowered so as to dump and entirely clean the box.

The incinerator is of the Decarie type, of 300 tons capacity, and developing about 1,500 degrees of heat. It is operated straight through the twenty-four hours, the work being handled by three shifts. Two incinerators with basket grates burn the material. The basket grates are a notable feature. They consist, as the name implies, of a basket formed of three-inch piping placed parallel and joining on to a six-inch header at the bottom in such a way as to form a basket, permitting free and ready access of air to the charge and giving a hot flame throughout the grate area. Between the two grates is placed a Wickes tubular boiler with a Dutch oven attachment for making use of the hot gases in producing steam. An induced draft from a fan located in the small shed shown at the side of the stack furnishes the air for burning and a system of by-pass pipes permit of the regulation and distribution of this draft. The power derived from the utilization of the heated gases from the incineration amounts to about 500 h.p. and supplies the work house, the green houses, superintendent's house and the Hopewell tuberculosis hospital with light and power.

In 1901, when the incinerator was first constructed, it did not have the present efficient means of handling the garbage. At that time all the material was dumped into a large circular tank, from which it was carried on an interior conveyor to the charging hoppers. This tank is now used for shower baths for the employees, and the garbage is not left standing to create a nuisance. One factor that perhaps might be criticised is the

practice of making the prisoners at the work house open some of the garbage each day and sort out vegetable refuse for feeding the animals at the work house farm. This is the only instance of handling the garbage by hand in the entire process.

At present the plant is taking care of 100 tons per twenty-four hours; using only one of the two furnaces. The process produces about 3 per cent. of ash, and that in such a form as to be readily handled. The fuel cost is about six cents per ton, and the entire cost of disposal, not counting any income from the power utilized, is 35 cents per ton. After October first there is to be a charge of 3 cents per kilowatt for electricity and 8 mills per pound of steam used, charged against the work house, etc. This will reduce the cost of disposal to about 18 cents per ton.

To Dr. P. M. Hall, health commissioner of Minneapolis, is great credit due for the efficient and sanitary solution of the garbage question, and to his idea of draining and wrapping the garbage more than any other thing is due the absence of nuisance at all stages of the process.

Brick Roads at the International Road Congress

By Prof. E. D. Rich, Ann Arbor, Mich.

THERE appeared in *Engineering News*, under date of Sept. 1, 1910, an article giving the "final conclusions adopted by the Second International Road Congress at Brussels." It is fair to assume that these final conclusions represent a summary of the discussions which took place at the Congress. Inasmuch as there were present at that meeting some delegates—we are not informed how many—from the United States, it will doubtless come as a surprise to American road and municipal engineers that no mention whatever was made of the use of vitrified brick as a paving material, for both city streets and country highways. This omission would not have been so strange had the Congress been composed entirely of engineers and road experts from countries foreign to the United States where brick is so extensively and successfully used as a paving material, but with American road specialists present it is indeed a cause for wonder that they did not introduce into the discussions the experience of our road officials on this very important and useful material.

Had it been generally recognized by the Congress how fully vitrified brick as a paving material meets all the requirements for an ideal roadway, it would doubtless have received the most prominent place in the discussions of any method of road covering.

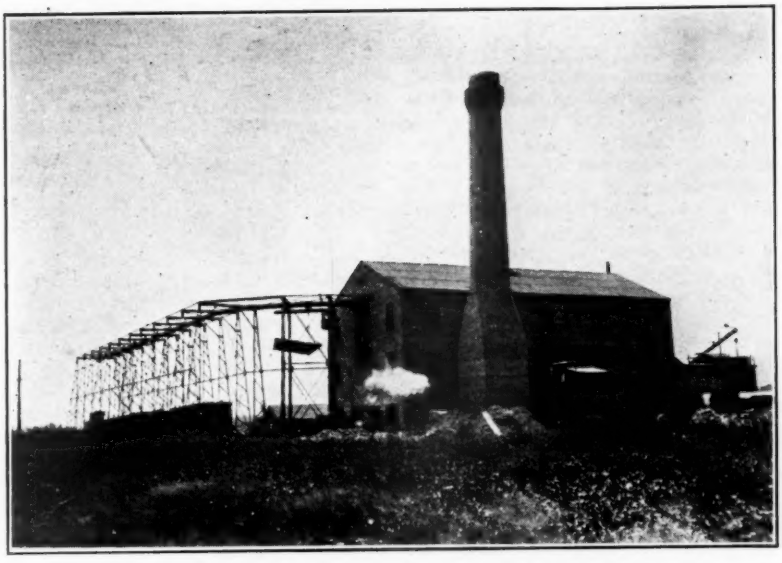
Let us see how brick compares in usefulness and durability with the paving materials mentioned in section 5 of the article above referred to.

In (1) waterbound macadam is admitted to be satisfactory only under exceptional conditions of very light travel.

In (2) macadam reinforced by any of the binding agents which have appeared in such vast varieties during the past few years, is classed purely as an experiment, and well may it be so classed until more than the present brief experiments of a year or two can be pointed to for justification.

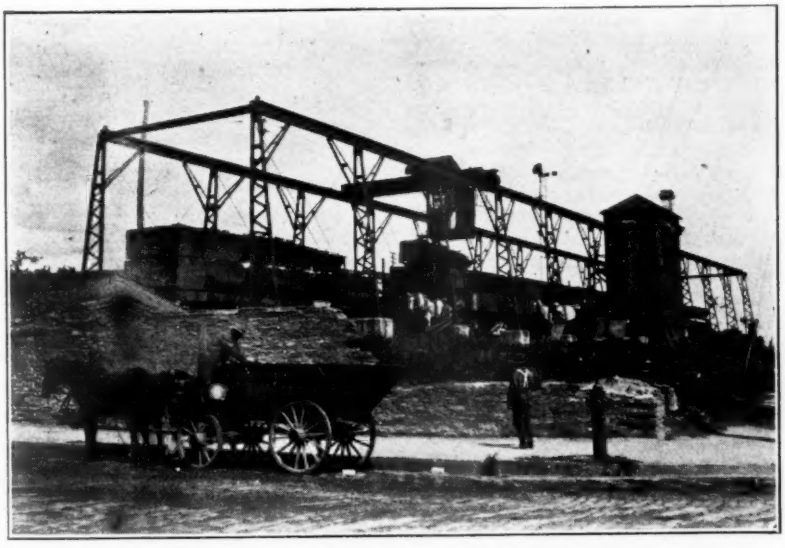
That brick paving has long since passed the experimental stage is conclusively demonstrated by the results obtained by the cities of Cleveland, Ohio; Terre Haute, Indiana; Paris, Illinois, and many others. When a brick street such as South Sixth street in Terre Haute can be seen with no measurable decrease in the depth of the brick apparent after twenty years of hard service under heavy traffic, the material and method of construction can hardly be regarded as an experiment. With such results attained, who can, with any certainty, predict its ultimate period of usefulness.

In (3) and (4) stone pavements are commended for their durability, ease and economy of maintenance, freedom from the production of dust and suitability adjacent to tracks. In this connection it is sufficient to say that a properly constructed vitrified brick pavement meets fully all these requirements, and in addition is much smoother than any stone pavement can possibly be made, rendering it far



GARBAGE DISPOSAL PLANT AT MINNEAPOLIS, MINN.

Apparatus for Transferring Garbage Wagon Boxes from Cars to Charging Floors of Furnace is Shown at the Left.



APPARATUS FOR TRANSFERRING GARBAGE WAGON BOXES TO CARS AT TRANSFER STATION, MINNEAPOLIS, MINN.

more easily kept clean and sanitary and reducing the noise problem to a minimum.

Those who are familiar with good block pavements will doubtless take issue with two of the statements made in (6). That it is not slippery is not at all borne out by American experience. That it stands heavy traffic is perhaps true for a time, but the life of this material has proved so short in many cases that it can not be said to be durable under any kind of traffic. The serious results of expansion, due to absorption of water after the preservative has evaporated is sufficient reason for its condemnation.

Hygienic qualities are mentioned in (8) as an advantage in the case of sheet asphalt, but just what constitutes a sanitary pavement is not enlarged upon. Medical knowledge and bacteriology have now fairly well demonstrated that certain diseases are communicated through the air, and are carried in clouds of dust. The germs of these diseases—for example, pneumonia, tuberculosis and influenza—find lodgment in the human body by way of the respiratory organs, and must be inhaled in order that infection may take place.

Another class of diseases, such as typhoid fever and cholera, are communicated by way of the digestive organs, and the germs must be swallowed to prove effective.

Still another class of germs, for example tetanus or lockjaw, obtain entrance to the human system through abrasions of the skin. Evidently the last two classes need not be considered in deciding upon a pavement which is sanitary, but the diseases of the first class, those carried in the flying dust to the nostrils of the people are so prevalent and so dangerous that no pains should be spared to reduce the dust nuisance to a minimum. This can be accomplished in two ways. First, by providing a pavement whose surface is constantly moist enough to prevent the dust upon it from being constantly blown about; and second, by constructing a surface which can be easily and thoroughly cleaned. The first result can only be accomplished by treating the roadway with a hygroscopic salt or with oil, both of which are unsuitable except on macadam parkways, boulevards and light traffic streets. The second method is the all important one. It is evident that the finer the particles of dust, the more easily are they carried by the wind, hence a method of cleaning must be adopted which will effectively remove the fine dust. Ordinary sweeping either by machine or by hand must be accompanied by careful sprinking in order to avoid an intolerable nuisance. If too much water is used the fine dust is plastered down on the pavement in the form of mud and if too little germs are stirred up by the sweeping process to form a menace to the traveling public.

Thus far only one practical way has been devised for successfully removing fine dust on a large scale, and that is by a thorough washing. Therefore, a street which can be satisfactorily washed must at the present time be considered the most sanitary. Sheet asphalt meets this condition well, but a properly constructed brick pavement with the cement filler of the joints intact and worn flush with the top of the brick is equally sanitary, for in this case there are no depressions at joints or anywhere else to retain dust. This highly desirable result can be obtained by a proper and careful attention to the details of construction if carried out as recommended by the National Paving Brick Manufacturers' Association. A copy of directions can be obtained, gratis, by addressing the secretary, Mr. Will P. Blair, 521-23 Board of Trade Building, Indianapolis, Indiana. A brick street built in this way is equal to asphalt in every respect, and in addition it is far more durable, it can be repaired without the necessity of the expensive tools, supplies and equipment required for asphalt repairs, and is ideal for use between and adjacent to car tracks.

In (10) further experiments with asphalt blocks are recommended. This field of investigation does not seem especially inviting, in view of the fact that the experience of many cities of the middle west has shown streets paved with this material in very bad condition at the end of five years. The fact that, in order to give sufficient hardness to make handling and shipping of the blocks possible, the asphaltic matrix must be mixed with so little oil that the life of the product is very materially reduced, will doubtless dampen the ardor of investigators along this line.

EDITORIAL NOTE.—The International Road Congress, held at Brussels in July and August, devoted itself largely to the consideration of highways, city streets taking a subordinate place. The Indiana delegate, in his report of the convention, in

MUNICIPAL ENGINEERING, vol. xxxix, page 171, expresses his surprise at the omission of brick from the list of materials under consideration. This was undoubtedly because there are few good brick pavements in European countries. This country was represented by but few delegates who were sent for the purpose, and apparently there were none who were specially interested or informed concerning the successful use of brick in this country for highways. Comparatively few engineers and road builders have had the opportunity of examining the hundreds of miles of brick-paved highways radiating from Cleveland, and so there are very few who have seen the demonstration of their value and have been able to compare them with roads paved with other materials. Brick is no experiment and Ohio is now the demonstrator of its success on roadways, as it has long been on city streets.

Phalen Park Bridge, St. Paul, Minn.

By James Cowin, Minneapolis, Minn.

PHALEN PARK is situated about thirty minutes' ride by trolley from the heart of Saint Paul, and is one of the most beautiful of the large number of similar breathing spots which make the Twin Cities famous as a summer resort. The park embraces Lake Phalen, approximately a mile in diameter, and a considerable stretch of wooded, rolling country to the west of the lake, through which the Park Board has cut a number of lagoons and channels. These are spanned at intervals by foot bridges of wood and steel which will probably be replaced in time by more artistic structures of concrete and masonry.

Early in the spring of this year the Park Board laid out an automobile road through the park and, deciding to put in a bridge which would be substantial and monumental in character, they called for bids on reinforced concrete designs. The bid of Jacob Lauer, based on a design by C. A. P. Turner, of Minneapolis, was finally accepted. The completed structure is shown in the accompanying photograph.

The basis of the design is an arch between two piers supporting a flat slab. The span in the clear is fifty-five feet, with a height of twelve feet nine inches in the clear from the high water line, a horizontal line drawn through the intersections of the under side of the arch with the piers. The bottom chord is a segment of a circle drawn with a radius of thirty-six feet, while the top of the arch has a radius of forty-eight feet six inches. The longitudinal reinforcing consists of ¾-inch round rods, spaced eighteen inches on center at both the top and bottom of the slab. Five-eighths inch round rods are laid laterally across these, also at intervals of eighteen inches. The arch tapers from the middle as indicated by the two different radii, and is one foot four inches at the narrowest dimension.

The roadway proper is designed like an ordinary rectangular panel in a building, except that the thickness is slightly increased at the middle, at which point it is twelve inches thick. The total width is forty-one feet eight inches, and the over-all length of the roadway slab is one hundred and eight feet.

After the excavation for the piers was completed, centering was at once started. The system of centering was novel, and could only be used to advantage under special conditions, such as occurred in this particular instance. Mr. Lauer had a large amount of short length six by six timbers on hand, which represented the waste lumber from a former job. He cut these down to about four feet, beveled the ends and formed the pieces into arched girders much after the fashion that a masonry arch is constructed. A number of these girders were erected across the channel, and the pine centering was laid across them. An accompanying photograph shows this false work. As stated before, the lumber used was already on hand and much of it can be used again, so that it is impossible to tell the exact cost of this part of the work, but Mr. Lauer estimates the loss in cutting at approximately $400.

The steel was then placed as outlined, 16,442 pounds of various sizes of round steel being used, the labor cost averaging about $9 per ton for handling.

The piers were built of two-man rubble unified with a mortar composed of one part cement and two and one-half parts of sand. The concrete used in

the remainder of the structure was a standard mix, comprising one part of cement, two of sand and four parts of crushed rock. One thousand one hundred and twelve barrels of Portland cement were used, costing an average of $1.35 per barrel. Three hundred and fifty yards of sand, costing 80 cents a yard f.o.b. the site were required, and 672 cubic yards of crushed limestone were contracted for at $1.40 f.o.b. the tracks, 90 cents a yard more being required to get the material delivered at the bridge.

The entire labor cost amounted to $4,783, no effort being made to keep the various divisions of the work separate in this respect.

The ornamental railing is of artificial stone, and was furnished by the National Stone Manufacturing Company, of Minneapolis, and adds much to the appearance of the bridge.

Work was finished July 1, and St. Paul now has a bridge built at slight cost which has added fifty per cent to the appearance of the park, and which will last forever. There will be no maintenance costs and its beauty will increase with time, as its newness wears off and the ground assumes its original undisturbed condition.

PHALEN PARK BRIDGE, ST. PAUL, MINN.

ARCH CENTERING OF PHALEN PARK BRIDGE, ST. PAUL, MINN.

Pneumatic Tests of Cast Iron Pipe

By W. R. Conard, Burlington, N. J.

IN a paper before the Central States Water Works Association, held in Indianapolis on Sept. 20 to 23, Mr. W. R. Conard, of Burlington, N. J., tells of some interesting tests of cast iron pipes.

Two corporations, wishing to put in some pipe that would be absolutely tight when laid and in service, ordered from two separate manufacturers a quantity of pipe. In addition to the usual hydrostatic tests it was provided that each pipe should be carefully tested with air compressed to 50 lbs. per square inch, and that while under this pressure soap and water should be applied to reveal open or porous iron or defects. Because of this specification the companies submitted only the best grades of iron of a close and uniform texture.

The results were that in one case there were 4,954 pipe tested either hydrostatically or pneumatically; of this number 27 leaked under hydraulic pressure and 272 leaked under pneumatic pressure, those leaking under pneumatic pressure having already passed the hydraulic test; this makes a percentage of leaks of the whole quantity tested 0.545 of one per cent. for the hydraulic, and approximately 5.5 per cent. for the pneumatic, or slightly over 6 per cent. for the two tests. In the other case there were 2,737 pipe tested, of which 14 leaked under hydraulic and 186 leaked under pneumatic pressure; the percentage being 0.511 of one per cent. for the hydraulic and approximately 6.8 per cent. for the pneumatic, or about 7.3 for both.

Analyzing further it will be noticed that the percentage of hydraulic leaks to the total number was but about 6.2 per cent. of the total number of leaks, taking both jobs together. This proportion, however, would undoubtedly have been more evenly divided had the hydraulic pressure in testing been maintained for a longer period of time per pipe, for as previously stated air compressed will find its way through open or porous metal more rapidly than water compressed, but in view of the fact that all of the pipe were to be subjected to an air test subsequent to the hydraulic both manufacturers depended more on developing leaks with the air rather than with the water.

Mr. Conard recommends that the cast iron pipe used in water works piping should be subjected to this air pressure test, though the pipes under test were for carrying gas. He thinks that the ultimate economy will more than offset the present increase in cost necessary to obtain pipe that will pass the more exacting test.

The Concrete and Macadam Streets of Richmond, Ind.

THE concrete pavements in Richmond, Ind., are constructed much as ordinary brick pavement, except as to the top surface. The subgrade is prepared and the base laid exactly as in the case of brick, except that perhaps more care is given to the matter of sub-drainage as the injurious effect of freezing and heaving is more marked in the case of concrete paving than in that of brick. After the concrete base is set hard enough to permit of working over it, a layer of sand is spread over it and brushed off so as to fill the hollows in the base. Upon this is placed a layer of thin tar paper (or other suitable paper) to form a separating layer. Upon this is deposited the wearing surface in ½-inch layers, which are thoroughly tamped. This surface is a 1-1-1 mixture of cement, sand and clean limestone or granite screenings. This surface is troweled off and finished much as that of a sidewalk.

A report compiled by the city engineer of Richmond, Fred R. Charles, gives a complete statement regarding the conditions of the concrete pavements at the present time and the table of costs shows that the pavements closely approximate the ordinary sidewalk in expense of construction.

"The feasibility of using concrete as

a paving material for roadways is now being widely considered, and as Richmond was one of the pioneers in this line, we have received dozens of inquiries. In answer to these and as a matter of general interest, I beg to submit the following information:

"Our first concrete pavement was constructed in 1896 in the alley adjacent to the Westcott Hotel. Being a narrow alley, a large traffic was concentrated in a small space; nevertheless, after twelve years, this pavement shows almost no signs of wear. A slight sinking of gravel around the foundation of the hotel has caused a little settlement of the alley, but this, which would be disastrous with other forms of pavement, has only resulted in a slight unevenness of the blocks, which have not even cracked.

"In 1902, Sailor street was paved with concrete, and now is in almost perfect condition. In 1906 it was necessary to cut a trench the length of this street to lay telephone conduits, and the concrete was found so hard that it only could be cut with great difficulty. On completion of the conduits the pavement was very carefully repaired and now seems as good as new.

"In 1903 concrete was put down at North A street and Seventh, a very busy intersection of two principal streets, and in 1904 on Elm Place, a street adjacent to the Arlington Hotel and several wholesale establishments, which carries a great deal of heavy hauling, especially from the hardware and iron storage houses of Jones Bros. Hardware Company, which is claimed to be the largest and best equipped hardware store in the United States. These last two pavements were laid in large blocks with expansion joints one inch wide, filled with pitch. These wide joints are a disadvantage, since the edges of the blocks begin to chip a little at these places. With the exception of these places and a few temperature cracks, which cause no serious detriment, the pavements are in excellent condition, and will apparently last for years with no repairs or maintenance charges. On our later work we do not use the wide joint but

CONCRETE STREETS AND ALLEYS.

	Year.	Cost per Sq. Ft.	No. of Sq. Yds.
Alley east of the Westcott Hotel	1896	26.8	140
Alley 1st south of Main, 8th st. to alley east	1901	14	242
Alley bet. N. 15th and 16th sts, Main st., north	1901	17	162
Alley (private)	1901	15	222
Driveway No. 1, hose house	1902	20	88
Sailor st. from N. 8th to N. 9th st.	1902	14	644
Intersection on N. 7th and N. A st.	1903	16.5	481
Alley 1st south of Main, 19th to 20th st.	1903	15.9	333
(Street) Elm Place, N. 9th to N. 10th st.	1904	13	650
Alley bet. S. 8th and 9th st., Main to alley east	1904	15.5	184
Driveway No. 3, hose house	1905	15.5	88
Driveway No. 4, hose house	1906	15	88
Alley bet. S. 18th and 19th sts., from A st. north	1906	15	1142
Alley 1st north of Main st., from 6th to 7th	1906	13.3	311
Alley bet. N. 6th and 7th sts., from A st. south	1906	13.3	454
Alley bet. S. 7th and 8th sts., from Main st. south	1906	15	184
Alley south of Main st., 8th to alley east 6th	1906	14.5	700
Alley second south of Main st., from 5th to 6th st.	1906	15	300
Smith st. from S. 5th to S. 6th st.	1907	14.5	600
Market Place, cor. S. 6th and S. A sts.	1907	15	1611
Alley 1st south of Main st., 9th st. west	1907	15	247
Driveway No. 2, hose house	1907	16	170
Alley bet. N. 8th and 9th sts., N. A st. to Sailor st.	1907	13.75	170
Alley 1st north of Main st., N. 9th to N. 10th st.	1908	11.8	750
Alley bet. S. 6th and 7th st., Main st. south	1908	11.8	222
Alley 1st south of Main, S. 9th to S. 10th st.	1909	12	555
Alley bet. S. 9th and 10th sts., Main st. south	1909	12	226
Alley bet. N. 9th and 10th sts., from N. A st. south	1909	11.5	670
Alley bet. N. A and Main sts., from N. 7th to 8th st.	1909	11	663
Total area			11,856

find the ordinary sand joint satisfactory.

"In addition to those mentioned, we are constructing concrete pavements every year, more especially on alleys, which are in the busy portion of the city and carry a large traffic in the way of drays, brewery wagons, and other heavy hauling. This travel, concentrated in a small space, constitutes a more severe test than on streets where it can be more distributed. Our citizens are very well satisfied with this form of pavement.

"Contrary to asphalt and other materials, it is not damaged, but actually benefited, by water. Consequently it can be flushed with a hose and is very easily kept clean; an important item from an esthetic and sanitary standpoint.

"The initial expense is moderate. It cost us about 30 per cent. less than vitrified brick. Repairs and maintenance charges apparently will be nothfor a great many years, and the life of this material will doubtless equal or exceed that of brick.

"It is somewhat slippery for horses, about the same as brick. Many drivers prefer it to brick on that account, while others, of course, prefer the latter. Even when wet it is not so slippery as asphalt. It is significant that those who reside on these streets and use them most and have the best chance to observe them, are the most enthusiastic in favor of concrete."

The pavements mentioned in the report are most of them in splendid condition. The chipping mentioned is more noticeable along the longitudinal joints, where the tires of wagons have apparently slid and crushed the sides of the cracks to a certain extent. Even this fault is only found on those pavements where exceptionally wide joints have been made. It is a noteworthy fact that on those pavements where no central longitudinal joint has been made and where the slope is toward the center, cracks have formed, running along the center and branching to either side. These cracks are not so large, however, as to be troublesome.

Macadam Streets.—The conditions in Richmond are ideal for paving construction of any sort. The soil is sandy and most of the streets have been graveled and the gravel compacted. Most of the streets have concrete curb and gutter built where the street is graveled. The only preparation necessary for macadamizing the street is to remove a portion of the gravel on either side of a strip through the center and spread this central strip to make the foundation for the whole street. Upon this base is spread a layer of 6 to 10 inches of stone and the whole is compacted by wetting and rolling with a 16-ton roller. Care is taken to work towards the center so that the material is formed into the general crown desired. A layer of screenings and stone dust is then applied and wetted and the rolling again continued until, to use the street commissioner's words, "it's had enough."

The finished streets, some of which have been in constant use under heavy traffic for six or eight years, show very little effect of wear, except where a trench has been made for cross pipes, or where horses have been hitched along the curb and have worn hollows. The latter, however, are never deep and the material is not loosened and scattered. Water seems to have no effect on the surface, except where it is allowed to stand in pools; the dust is not any worse than from a brick street which is not regularly cleaned; and the main apparent value of the pavement is in its clean, white appearance, in its comparative noiselessness and in its cheapness and ease of construction.

AVERAGE LENGTH OF BLOCKS 350 FT.

Street	Depth of Stone (inches)	Width Feet	Stone Used Yds.	When Built	Cost Per Block	Remarks
N. 8th	8	35	388	1904	$177	Surface in fair condition.
N. 15th ...	7	35	...	1904	296	Cost includes cross walks. Condition excellent.
S. 11th ...	6	35	...	1904	312	Poor subgrade. Shows a few ruts.
S. C	6	25	418	1904	95	No haul for stone. Condition excellent.
S. 12th ...	8	35	1110	1904	343	Condition good.
S. 13th ...	6	35	366	1904	271	Long haul. Condition good.
N. 13th ...	6	35	443	1904	131	Short haul. Condition fair.
S. 18th ...	6	25	147	1902	129	Condition good.

The table given herewith is compiled from data kept by Mr. D. C. Green, the street commissioner, who has had charge of a great deal of the macadam work. Mr. Green has kept careful account of his material, labor, teams, roller fuel and tool repair, and each street has been charged with all items.

The stone used is at present obtained at a distance of about six miles, at a cost of 85 cents per yard, and the freight charges are about 20 cents per ton, so that the hauling after the stone reaches Richmond is really one of the large factors of cost. All work is done by the city under the supervision of the street commissioner and the engineering department, and all work is paid for out of the city general fund, except in the case where the improvement is entirely new. Labor is paid at the rate of 20 cents per hour, teams draw 37½ cents per hour, and the engineer on the roller gets 25 cents an hour.

The macadam streets are cleaned only once per year, and the method employed consists of scraping the dirt into the gutters with hand hoes and then removing it from the gutters. The total of 16.71 miles of macadam pavements were cleaned in 1909 at a total cost of $2887.50.

The preference of Richmond for the macadam pavement is shown in the following report of 1909 relative to street mileage:

Kind of Pavement	Previously Built	This Year	Total
Brick	1.52	0.00	1.52
Macadam	14.01	2.70	16.71
Cement	.20	0.00	.20
Graded, graveled and bouldered	33.12	1.47	32.16
Pike	7.13	0.00	6.35
Unimproved ...	8.62	0.00	7.66
Total Miles.....	64.60	4.17	64.60

The total mileage of improved roads shows the progressiveness of this city of 23,000 population.

Cement Streets of Fond du Lac, Wis.

By an Editorial Correspondent

IN MUNICIPAL ENGINEERING for August a discussion was given of a paper by J. C. McCullough, city engineer of Fond du Lac, Wis., on cement streets. Some further comment on the points of difference in these and other cement streets might be of value.

The preparation of the base and 5-inch concrete foundation is identical with the process employed on other forms of pavement. After this foundation has been placed and before it sets, a wearing surface 1½ inches thick is placed upon it. This wearing surface consists of 1 part of Portland cement, 1 part of clean, sharp sand and 1 part of granite screenings. This layer is then brought to an even surface, troweled, and a steel broom is dragged across it so as to bring the coarser particles to the top and to give a rougher face. With the exception of a transverse expansion joint placed at 50-foot intervals (or less) there is no break in the surface of the pavement between the curbs.

The fact that granite screenings and sand are both used in making the top coat is intended to prevent the surface from becoming slippery. It may be said to be very effective in this particular. The theory set forth in this particular combination for the surface coat is, that the cement and sand particles will become worn away leaving the screenings protruding so as to roughen the surface. This is in fact what takes place and the pavements even when newly sprinkled are by no means slippery. One test block in the city engineer's office was ground against a wheel used in a tombstone factory for polishing stone. This piece exhibited particles of granite exposed varying in size from ¼ of an inch to the finest.

It is the practice in Fond du Lac to provide cement streets only where they are petitioned for by the property owners. The fact that at the close of this year there will be 8.6 miles of cement streets built at an average cost of $1.21 per square yard is the best testimony to their having given satisfaction in Fond du Lac. The amount of cement street work done each year reaches close to $100,000.

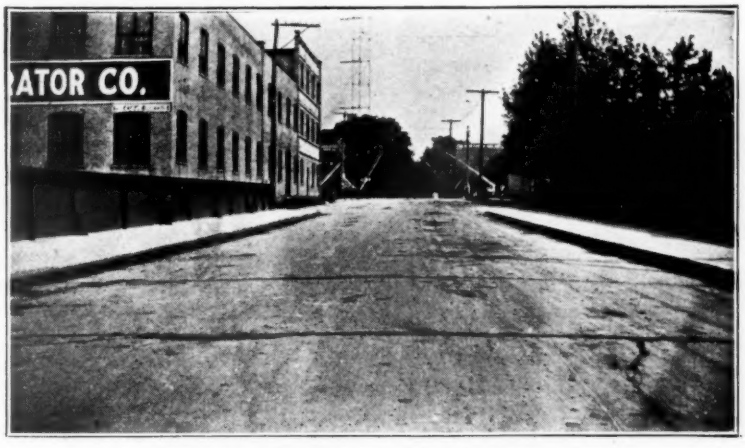
Fond du Lac claims the superiority of her cement streets over other types in the matters of durability, of sanitation, and of lack of slipperiness. Dur-

ability has not yet had a thorough trial, as the oldest pavement has only been built about two years. An accompanying photograph shows one of the streets constructed in 1908.

In the older pavements a great many cracks have formed, most of them running in the general direction of the street and near to the center. These cracks and the edges of the expansion joints are chipped and worn to a noticeable degree. The hollows are filled with dirt, as may be noted from the accompanying photograph. But even this would seem to be superior to having a number of transverse grooves to become filled with refuse and to make sweeping difficult. The matter of longitudinal cracks is at present receiving attention and a reinforcement of triangular net wire is being placed between the foundation and surface of the pavement.

Most of the cement pavements of Fond du Lac are in splendid condition and the conservative statement of the city engineer that they are a good "cheap" pavement seems entirely true.

CONCRETE STREET IN FOND DU LAC, WIS.
Transverse Joint, Showing Wear.



CONCRETE STREET IN FOND DU LAC, WIS.
Note Transverse Joints and Longitudinal Cracks.

EDITORIAL COMMENT

City Refuse Collection.

State Control of Sewer and Water Systems.

CITY REFUSE COLLECTION.

The long neglected problem of the collection and disposal of city wastes has at last been attacked in something like a scientific manner and some fairly satisfactory results have been obtained, so far as disposal is concerned. There is too much tendency toward imitation in this, as in other municipal matters, with resultant total or partial failures where conditions are so different that the methods used in one city cannot be applied in another. Most of these failures are due to the differences in methods of collection of refuse and in the matters included in the collections.

The fact is that the collection of the refuse is quite as important a matter as its disposal, and may be quite as much of a nuisance, although it may be so scattered in place and time as not to give rise to serious objections. The various classes of refuse may be described as follows:

Garbage, meaning animal and vegetable refuse which attends the preparation of food for consumption, is large in amount and productive of great nuisance if not properly taken care of. It is therefore the main object in view in considering the disposal of the city's wastes, always excepting sewage as otherwise taken care of. There is a certain amount of value in garbage, which attracts the attention of many, and reduction systems, feeding of hogs, etc., have been used to rescue this value. From the point of view of this value, the garbage of cities varies greatly, and the garbage from different parts of the same city varies greatly. The garbage from hotels, restaurants, large boarding houses, flats, etc., where it accumulates rapidly enough to warrant removal at frequent intervals, is of high quality, and but little fermented, and has a commercial value often sufficient to warrant private contractors in removing it without charge or even paying a small sum for the privilege of removing it. In the latter case the garbage is, in the full sense, property, and under Pennsylvania decisions is under the control of its owner, subject, of course, to reasonable rules and regulations regarding its sanitary storage, removal and disposal. The garbage from residences generally does not accumulate rapidly enough, nor are these accumulations close enough together, to make the material of sufficient value to warrant any one in collecting and disposing of it without charge, not to speak of paying for the privilege. This class of garbage is, therefore, a constant source of expense to the householder, if he must pay for its removal, or to the city, if there is a general public system of removal. It can hardly be classed as property, and is subject to the control of the city council and the department to which the operation of the garbage disposal system is intrusted.

Commercial garbage includes not only the garbage from hotels, etc., above referred to, but also the refuse and spoiled materials from markets, vegetable and fruit commission houses, groceries, meat, fish and fowl shops, and slaughter house sand docks. Some of these wastes have considerable value.

Manure is another kind of refuse which has a certain commercial value in some cities, but is sometimes, especially in the larger cities, difficult to dispose of for the householder who has but a single animal, so that it must sometimes be added to the refuse to be collected by the scavenging department of the city.

Dead animals have a value which,

in the case of the larger animals, may be sufficient to make them property in a real sense, for which a small sum may even be paid. The small animals ordinarily find their way to the garbage disposal plant.

The ashes of a city usually amount to a larger tonnage than all its other refuse. If kept by themselves, they are clean and wholly unobjectionable, except as they may be so handled as to produce dust in handling, carting or depositing. They have a considerable proportion of unburned or partly burned coal, which is sometimes considered worth saving. Ashes and cinders from manufacturing plants have less coal, but are sometimes available for making porous foundations for walks and the like or for making concrete, and so may have a certain property value.

Street sweepings are often treated in the same way as ashes, i. e., used for filling. Paved streets which are crossed by unpaved streets have a large proportion of inorganic matter in their sweepings, and the organic matter is probably largely manure, so that the street sweepings can be used for filling, if the health department will keep the process under inspection and see that the materials and methods of depositing them conform at all times to sanitary requirements. If hand labor is used in picking up droppings during the day, their collections may be treated as manure is treated.

There is a considerable volume of refuse from a city which is not included in any of the classes above described. Its weight is comparatively small. This refuse, most of it, is reasonably clean, though some of it, for example, mattresses from sick rooms or hospitals, may be dangerous from a sanitary standpoint. Much of this matter is combustible, but some of it is not, and may be objectionable about a disposal plant. Some of it is commercial in the sense that it has sufficient value to warrant private collection, but, especially in households, the quantity and regularity of production may not be such as to bring it into the commercial class.

The combustible refuse consists of paper, wood, straw, grass, tree trimmings, mattresses and other cloth, etc. Mercantile and manufacturing establishments may have enough such material of commercial value to derive quite a revenue from its sale.

Incombustible refuse includes such household waste as tin cans, bottles, broken crockery and glass, leather, metals, remains of building repairs, etc., besides occasional earth, brick, cement, mortar, etc., the result of more extensive building or repair. Some of this material is of sufficient value to make fortunes for the junk men who go about gathering it up, and the remainder is probably not any more objectional than ashes for use as filling. Such material as cans, broken crockery and glass are difficult to dispose of, because they are not wholly satisfactory as filling and are not destructible.

Night soil is a class of municipal refuse which should rapidly become less in amount. A city with complete municipal sewer and water systems should be able to enforce water and sewer connections so that such deposits need seldom occur, and the board of health, by a strenuous campaign, could substitute the earth closet for the vault, where something is necessary, and thus reduce the nuisance of disposal. The nuisance of the earth closets would not be greater than that of the vaults now is, and it is readily subject to control by inspection, while the latter is very difficult of control. The amount of material to be removed would be greater, and it might be necessary to furnish the dry earth, but in the very small sections of the city without sewers, and during the comparatively short time before the sewer and water pipes are extended, the earth closet system should be a great improvement over the vault system. The board of health doubtless can, and certainly should, make it impossible to have a deposit of night soil in areas having sewers and water.

It is evident that these various classes of refuse will vary greatly in

amount in various cities and at various times of the year. It is also evident that opinions of property owners, city officials, contractors, and others interested, will differ as to the value of the various classes of refuse and as to what should be done with them for the purpose of extracting this value at the same time that the nonproductive parts are disposed of. Too often this attempt to save results in nuisance or danger to health far greater than any actual saving.

Whether each class of refuse shall be collected separately, or two, three or more together, is a question of importance, both as regards cost and sanitary conditions, and as regards the method of disposal adopted. It is evident that the method of disposal depends directly upon the method of collection adopted and that the two are inseparably connected. Unfortunately, this connection is too often overlooked, and the disposal plant is a failure through no fault of its own, but because it has not been chosen to suit the conditions existing.

There are almost as many variations in the methods of separating and collecting refuse as there are combinations of the kinds of refuse above listed, no two cities agreeing exactly in these matters and practically all of them having radically defective methods of collecting one or more of the classes of refuse. The description of the method of collection of garbage, combustible and incombustible refuse, and ashes, in Minneapolis, given on another page of this number of MUNICIPAL ENGINEERING, shows a system far better than the average, but one which should not be followed blindly. Descriptions of other methods of collection will be given from time to time.

The purpose of the writer will be effected if the emphasis put upon the necessity of adequate methods of collection of the city's refuse will lead to the same careful study of the subject in each city that has been given to the disposal of the collected refuse in a few of the cities of the country.

STATE CONTROL OF SEWER AND WATER SYSTEMS.

The state of Kentucky has been added to the list of states exercising more or less control over the pollution of streams by sewage and over the purity of water supplies, bringing the number of such states to about one-fifth the number in the Union. Kentucky has not given its State Board of Health much more power, or money, than its latest predecessor, Indiana, gave to its sanitary authority, but the state has provided for a state sanitary engineer, the first incumbent of the office, Paul Hansen, taking the office September 1.

The State Board of Health has provided work for the engineer's office to the limit of the appropriations by adopting rules requiring the submission to the board of plans for sewers and water supplies, for changes in methods of treating water, for changes in methods of disposing of sewage, for location of sites for industries producing putrescible or otherwise objectionable liquid wastes, and for treatment of such wastes.

The last named rule is apparently aimed at the numerous distilleries in the state, the refuse from which is producing very serious nuisance in several localities.

Mr. Hansen will doubtless follow the general plan in use by the State Board of Health of Ohio, with whose work he has been connected for several years, and his experience and the limitations of funds may make progress in the work slow enough so that the education of the people and the legislature may keep up with it. If not, there may be such setbacks as have occasionally occurred in other states on account of antagonisms aroused among those affected financially by the new restrictions. When public opinion is not sufficiently educated, the results of such antagonisms are the repeal of the laws objected to or the withdrawal of appropriations. They also cause such delays in the passage of salutary laws extending the powers of the State Board of Health

as have been experienced recently in New York, laws which have not yet passed the legislature.

The public will support health laws when it sees their desirability, but will be indifferent to attacks upon such laws so long as it is ignorant. The main business of the Board of Health is therefore educational, and steady progress depends upon the ability of the leaders to take advantage of every opportunity for improvement in the laws, but at the same time good judgment in choosing the limit of advance at any such opportunity, so as not to get too far ahead of the main army.

THE QUESTION DEPARTMENT

Mechanical and Slow Sand Filtration of Water.

We want to ascertain the relative difference between the slow sand system of filtration and the mechanical system as to cost of installation, maintenance and durability.

A. H., Darby, Pa.

This question is not easy to answer in a general way. For any particular case general plans can be made and the two systems compared with reference to the local conditions, but these conditions vary so much that what is a proper system for one location may not be so for another. The following general observations may be of some value, however.

Slow sand filters require much more area than mechanical filters, and where cost of site is a large item may make the former cost much more than the latter, since the former filter water at the rate of 100 to 150 million gallons per acre per day and the latter at 2 to 6 millions.

Cost of construction of slow sand filters varies with the grading required, whether the filters must be covered or not, etc. Buildings and connections are the principal variants in a mechanical plant of like capacity.

In considering the cost of operation and maintenance of the filters there are so many variable items that data from operation of plants can be compared only with the fullest knowledge of the local conditions. An important factor is the rate at which the filter can be operated and produce the necessary purification and another the rate at which the filter clogs and requires cleaning. It is evident that, given two plants with the same cost of operation, if one has so much better raw water than another that it can be filtered at twice the rate, the cost of filtration will be only half as much per million gallons. The first cost will be greater in the case of the less pure water, because of greater area required to allow time for cleaning and for fluctuation in rate of demand for water. More frequent cleaning will be required, so that the cost of operation must be corrected for this expense also. This cost of cleaning varies greatly, in the slow sand filters the scraping of beds becoming necessary at intervals of 9 to 40 days according to purity of water, or a filter may require scraping after filtration of 25 million gallons in one case while in another it may filter 150 million gallons or more before requiring cleaning. The same principle applies but in different proportions in the case of a mechanical filter. Chemical treatment and sedimentation also greatly modify the rate of filtration and the frequency of cleaning filters.

Skill in operation has much to do with the cost of filtration.

With these warnings as to dangers in making comparisons between plants under different conditions, the following figures, gathered from various sources, may be given:

A cost of $30,000 an acre for slow sand filter beds is stated by Hazen as an average of American construction, with great variations and in the smaller plants an excess over this figure, in some cases, of 100 per cent. or more. If covered, the cost of filters will average near $50,000 an acre and may run to $75,000 as in Washington, D. C. The cost per million gallons of capacity would vary roughly from say $10,000 more or less for uncovered reservoirs to somewhere between $15,000 and $30,000 for covered reservoirs.

Mechanical filters cost $500,000 to $800,000 an acre of filtering area, the

latter figure including reasonably good buildings, or say $8,000 to $12,000 per million gallons capacity.

The mechanical filters operate so much more rapidly that the filtering area is much less than for slow sand filtration and the total cost of plant is only some 20 to 35 per cent. of the cost of the latter.

In Hazen's "Filtration of Public Water Supplies" ($3) will be found a diagram showing the cost of clarifying water by mechanical and sand filters for the special set of conditions at a plant not named and the conditions not definitely stated, which will show the impossibility of making comparisons of cost of operation in different plants unless all conditions are known and allowed for. From this diagram, if the water applied to the filter has 0 turbidity sand filtration will cost for operation only about $1.15 per million galons and mechanical filters will cost $1.60. But if the turbidity is 0.50 the clarification by mechanical filters will cost $4.55 and by sand filters will cost $6.85 per million gallons. He adds $3.50 to each as the cost of operation to produce a bacterial efficiency of 98 per cent. in purification of the water. Interest on cost of plant would make the total cost of maintenance more favorable to the mechanical filter. The general statement is made in Fuertes's "Water Filtration Works" ($3.50) that while the cost of installing a covered slow sand filter plant is from three to five times the cost of a mechanical filter of the same capacity, the total annual cost of operation is about the same, chemicals and greater allowance for deterioration in the mechanical plant offsetting the lower interest charges.

Cost of operating American slow sand filters varies from $2 to $3 per million gallons filtered.

London's average for 15 years was $1.24 per million gallons.

The average cost at Poughkeepsie for 20 years was $2.99 per million gallons, but of late years this has been greatly increased. Mt. Union averaged $2, Lawrence $5.80 before covering, over 40 per cent. of which was for care of ice on the filter in winter.

Turneaure and Russell's "Public Water Supplies" ($5) states that, including interest and depreciation the total cost of slow sand filtration may, under ordinary circumstances, be estimated at $7 to $9 per million gallons filtered.

Cost of operating a mechanical filter plant, according to Turneaure and Russell, is from $4 to $6 per million gallons under ordinary circumstances, and, including interest and depreciation, the total cost will run from $10 to $12 per million gallons.

As above stated, the cost in any individual instance may vary much from these statements of averages, and the two systems of filtration may change places. This is probably the case in many of the smaller plants, where cost of operation and of expert supervision of the operation of a slow sand filtration plant may very largely exceed that in the less sensitive mechanical plant, which may require only occasional visits from the supervising expert. There are very few slow sand filtration plants in small cities and there is little information concerning their operation. A description of the new plant at Ashtabula, O., is given in MUNICIPAL ENGINEERING, vol. xxxvi, p. 284. Results of operation of the open sand filters at Reading, Pa., are given in vol. xxxv, p. 252. One of these filters has only 250,000 gallons capacity per day and all costs of operation, not including capital charges but including cost of handling ice, amounted to $3.57. The other filter of over 3 million gallons capacity cost $3.31 per million gallons to operate.

Of the larger plants information is given in vol. xxxvii, p. 410 about the Washington plant, on p. 145 about the Pittsburg plant, on p. 245 about the new Toledo plant; and in vol. xxviii, p. 97 about Toledo and p. 387 about McKeesport. Lists of other articles on filtration and filtration plants will be found in vol. xxxvi, pp. 109 and 315.

Information About Water Pumping Plants.

Kindly send me list of issues of MUNICIPAL ENGINEERING for about a year back containing articles on water works, pumping plants and machinery, steam or electrically driven.

C. H. R., S. Framingham, Mass.

The following are the most important articles on this subject in the last wo volumes and the current volume:

Vol. xxxix: "The Water Works of Madison, Wis., p. 6; "The Water Works of Springfield, O.," p. 97.

Vol. xxxviii: "The Water Works of Marion, Ind," p. 4; "The Combined Electric Light and Water Works of Thomasville, Ga.," p. 249; "Lowering Water Level in Wells of Frankfort, Ind.," p. 256; "The Electrically Driven Water Works Plant at Mattoon, Ill.," p. 402.

Vol. xxxvii: "Valuable Data Regarding Water Supplies," pp. 258, 330, giving data regarding numerous water supplies in cities of 25,000 to 50,000 population, but little regarding pumping plants.

All these articles except those on Thomasville and Frankfort can be supplied at 25 cents each.

Cost of Pumping Water.

You would confer a special favor to me if you will give me information on what would be a reasonable price for pumping the water from the lake into the standpipe for one year. We have about 600 families as water takers and 2 flour mills and a flat, and 3 livery stables on meter. We have been paying $600.00 until 3 years ago; were then compelled to pay $1,000.00 per year; and now, the power plant asks further increase on the price

of pumping to compel the water works committee of the city of Boonville to pay over $2,000 for pumping. The city furnishes the steam pumps and keeps them in repair. G. S., Boonville, Ind.

This question cannot be answered without further information. It is possible that for the lift and other conditions existing at Boonville the cost of power for pumping water would be from $5 to $8 a million gallons. If the consumption were 300,000 gallons a day the first figure quoted in the inquiry would fall between these limits. If the consumption were 1,000,000 gallons a day the last figure would not be far wrong. It should be possible to make an estimate of the consumption by keeping a record of the pump performance or of the level in the reservoir for long enough time to give data for a reasonably accurate computation.

The cost of power stated is somewhere near the average and the cost in Boonville may be very different, as the range extends below, and in a few cases far above the figures given. The local conditions must be taken into account in fixing a fair price. A competent engineer can soon determine the actual cost of furnishing power, and the amount of power to be furnished can be ascertained by him after a comparatively brief investigation. The city would probably save money on a new contract by putting the determination of the price to be paid in the hands of such an engineer.

Boiler Capacity for Small Water Works.

Our city is about to install boilers at the water works plant. The idea is to have duplicate boiler power. The question arises as to what is the necessary horse-power required. As I see it, the best way to get at it is to put the horse-power required per standard fire stream based on 1¼ inch nozzle and 80 lbs. pressure at fire plugs, and in putting it in this way the council can readily see how many streams of water they want, and the question will be settled as to what they may expect. Pumping is done with common high pressure duplex pumps, with 5 miles of water main. Pumping plant is centrally located. We have agreed to submit the proposition to the Editor of MUNICIPAL ENGINEERING to be published in the Question Department of the next issue. JAMES O'ROURKE.
Supt. Water Works, Fulton, Ill.

This is a very general question and can be answered only in a very general way. The lifting of the water for the fire-stream named would require about 12 net horse-power and the energy in the steam applied at the engine must be, say, 20 horse-power in order to overcome friction in machinery and pipes, leakage, etc. If we assume average conditions for good installations in good order, one fire-stream might require 20 horse-power of boiler, but if conditions are not good, if losses are great, if efficiencies are small, if boilers or machinery are not in good order, the amount of steam made by the boiler may be increased by 50 per cent. in order to furnish the fire-stream required. Probably the horse-power of boiler required for one of the fire-streams named would lie between 15 and 30 according to conditions of operation and character of design.

There are numerous factors about which no information is given which will greatly influence the answer to the question, such as the regular pumpage for the every-day uses, the sizes of pipes and hydrant branches, to mention but two. If the pipes are small the above answer would apply only for the first fire-stream or two, and the horsepower required for additional streams would increase materially on account of the additional friction in delivery of the larger quantities of water and the additional pressure required at the pump to overcome this friction.

The fire-stream named is only a fairly good stream, but is probably sufficient for a small city with few buildings more than two stories high.

Books on Sewerage and Sewage Disposal.

Please give me the name of the best recent work on construction and maintenance of sewerage systems, including septic tanks.
A. B. M., Texarkana, Ark.

Folwell's Sewerage ($3), Wiley & Sons., and Staley and Pierson's "The Separate System of Sewerage" ($3) are both good books, giving many good points on design and construction as well as on the theory of the subject. The latter of course has to do with the separate system entirely. The first mentioned book (Folwell's) has just been issued in a new edition and is the latest publication on the subject of sewerage and sewage disposal.

Other good books will be found listed in MUNICIPAL ENGINEERING, Vol. xxxiii, p. 175.

Specifications for Sewer Construction.

I am preparing plans and specifications for the installation of a system of sewerage in a small town near this city, and am anxious to secure copies of standard forms of specification covering the various branches of the work, viz, excavation and backfill, pipe laying and building of man holes and catch basins, furnishing of terra cotta pipe, and furnishing of castings. There is also a small portion of the town which it is proposed to drain into a septic tank or to treat in some other manner. Could you furnish me with any copies of specifications covering any portions of the above, or refer me to such in your very valuable paper?
G. M., ————, N. B.

There is a brief outline of the points that should be covered in sewer specifications in MUNICIPAL ENGEERING, vol. xvii, p. 23. Some of the provisions of Pittsburg sewer specifications are discussed in vol. xix, p. 95. Specifications for brick for sewer construction are given in vol. xxiv, p. 430. Specifications for laying

sewer pipe are given in vol. xi, p. 35. Abstracts of specifications for concrete sewers of various sorts will be found in vol. xxii, pp. 19 and 169; vol. xxiv, p. 253; vol. xxv, p. 182; vol. xxvii, p. 248. A list of articles descriptive of concrete sewers in various cities is given in vol. xxi, p. 450. Specifications for concrete sewers are given in vol. xxxii, p. 314, and for concrete pipe on p. 164. Specifications for reinforced concrete pipe are given in vol. xxxv, p. 318. An article on "Methods of Sewer Construction in Clinton, Iowa," vol. xxxvi, p. 300, gives some good suggestions for sewer specifications. Brooklyn specifications for concrete pipe sewers are given on p. 384.

An excellent set of specifications for sewers and sewer materials will be found in Folwell's "Sewerage" ($3), a new edition of which has just been issued. Specifications applicable to septic tank construction will also be found in the book.

Treatment of Brewery Waste.

Can you advise system of treating trade waste from a brewery? It is not the intention to treat it primarily to discharge into sewers but for purification before discharging into stream. I would thank you for any data or name of publication you can give.

THOMAS PEALER,
Borough Engineer, Indiana, Pa.

The principal difficulty in treating brewery waste is in the souring of the waste before it is subjected to treatment. Naylor's "Trades Wastes" is an English book on their treatment and he describes therein a system of treating brewery waste in an auti-souring tank. The process is stated in brief in a review of Mr. Naylor's book in MUNICIPAL ENGINEERING, vol. xxv, p. 123. It is also given in brief articles in vol. xxii, p. 179 and vol. xxv, p. 34. The tank is fed by a constant flow of a small amount of house sewage, the bacteria in which counteract the souring of the brewery waste, and as a result the effluent from the tank is comparatively odorless and can be purified by filtering through coal, or can be discharged into a city sewer.

How to Prevent Slippery Sidewalks.

The City of Holly Springs is laying concrete side walks. And owing to numerous undulations and hills, grading will be out of the question. Now how best to obviate slick pavements in the winter, caused by freezing, is the question. Can you suggest a satisfactory remedy without grading. A corrugated surface is not desirable if something else will do as well or better. F. E. WEST, Mayor.
Holly Springs, Miss.

Cement sidewalks seem to work well, even in northern climate, on grades of 5 or 6 per cent. and as far south as Holly Springs there should be but few minutes in the year when grades even as steep as 10 per cent would make them objectionably slippery. Unless the city has very steep hills it should be possible to reduce grades within these limits with very little excavation. If the hills are so very steep, an occasional step or several of them can be put in, in which case the walk between steps should not be given more than, say 5 per cent. slope.

Will our readers give the results of their experience as to slipperiness of walks on grades such as those mentioned or steeper?

Who Makes Peet Valves?

Can any of your readers give me the information who manufactures the water works gate valves which are marked, P E E T? These valves have been in use for the past twenty-five years.
W. P., Supt. Water Works,
———, Mass.

Crown for Brick Street.

Will you please tell me what the height of crown should be for a 47-foot brick street which is in a business district and on flat grades? W. B. HOLMAN,
Rochester, Ind.

Various allowances are made for crown of street from ¼ inch per foot of the half width of street, which would give nearly 6 inches for the crowd of a 47-foot street, to the Omaha formula for crown in which 4 times the per cent. of the longitudinal grade is subtracted from 100, the remainder is multiplied by the width of the street and divided by 5,000, which gives 11¼ inches for the crown of a street with a level longitudinal grade. The modern tendency is for lower crowns, especially for block streets, so that 6 to 8 inches should be sufficient on a street in a business district. However, the cleaning of streets has something to do with the crown and if the streets are not kept clean the crowns should be increased toward the higher limit named.

Lists of American Water Works Systems.

Do you publish a list of water works throughout the United States and Canada, especially those which are equipped with pumps and not operated entirely by gravity system?
J. B., Philadelphia, Pa.

The "Manual of American Water Works" ($1.50) contains such a list, with full discussion of apparatus, etc., but the last edition of this work was issued in 1897, so that it is rather out of date. The "Engineering Directory," published by *"Domestic Engineering,"* of Chicago ($5.00), contains a list of water works, which is quite complete so far as cities of more than 10,000 population are concerned. This list is kept up to date, but it is very brief. There is also the "Municipal Year Book" ($1.50), the first and only edition of which was published in 1902, which contains information regarding all the utilities of cities of more than 3,000 population. It states in each case whether the water supply is by gravity or by pumping.

Concrete Reservoir Lining.

Not being posted in doing concrete work, putting better floors in two reservoirs, approximating 20,000 square feet, I would thank you very much for the following information:

1. Will Black Diamond serve well under water? It is made at Sellersburg, Ind. We can buy it f.o.b. here at 81 cents, 285 pounds in wooden barrel.

2. What is best mixture of cement, sand and gravel, or 2-inch macadam rock, if Black Diamond is suitable.

3. If not, what Portland is best suited for reservoir bottoms?

A. S., ————, Ky.

1. Black Diamond is a natural cement of the Louisville group. Natural cement may be used where it is entirely submerged under the low water mark, or where there is no danger of its being exposed to the action of the weather by cutting away the surrounding earth. It may be used where there is a firm and uniform foundation and where it is not exposed to the wearing action of the water, as natural cement concrete does not possess great strength, nor does it offer great resistance to wear. It should never be used in reinforced concrete work. Black Diamond brand has an excellent reputation as a natural hydraulic cement.

2. With regard to the best mixture for natural cement concrete: 1 part of cement to 2 parts of sand and 5 part of crushed stone (or gravel) gives a good mixture. Wherever a stronger mixture is required a 1:2:4 proportion is recommended. If Portland cement is used a 1:3:6 or a 1:2½:5 mixture may be used. In using natural cement the gravel concrete has one-half to three-fourths the strength of the broken stone concrete; while with Portland cement there is little difference, though the broken stone gives a stronger concrete. Gravel concrete made with natural cement increases in strength with age.

3. Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the heading "Portland Cement," for names of manufacturers of cement suitable for reservoir work, in event that it is decided that natural cement will not give sufficient strength. Under the heading "Cement" will be found also names of dealers in and manufacturers of natural hydraulic cement.

It would seem that the main point under consideration in the construction of these reservoir floors would be the matter of preventing leakage. The first factor to consider in this case is to get a mixture of cement, sand and gravel, so as to obtain a minimum of voids. The above-mentioned proportions are of course general and are made with the matter of strength rather than watertightness considered. The correct proportions with reference to minimum voids vary with the material at hand and may be determined exactly, only by making a sieve analysis of the gravel and sand to be used. Some good waterproofing compound might be used to advantage also. Any one of the common forms of compounds to be mixed with the concrete may be used; or the bottom of the reservoir might be coated with some asphaltic waterproofing compound. Either method has been found to give satisfaction when properly applied.

Standard Specifications for Portland Cement.

In your issue of April, 1910, you print the report of the Committee of the Organization for Standardizing Paving Specifications, especially in regard to concrete pavements. They report that the tests and requirements for Portland cement shall be the same as those adopted August 16, 1909, by the American Society for Testing Materials. Now would it be asking too much of you to procure me a copy of this cement requirement? Or advise me where I can obtain same?

H. H. T., Norfolk, Neb.

Copies of the standard specifications and methods of test of Portland cement adopted by the American Society for Testing Materials can doubtless be obtained of the secretary of the society, Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.; also of the Association of American Portland Cement Manufacturers; also of most of the manufacturers of Portland cement listed under the heading "Portland Cement" in the "Business Directory" printed in each number of MUNICIPAL ENGINEERING. The "Handbook for Cement Users" ($3) contains the specifications adopted by the American Society for Testing Materials, complete, except the slight and unimportant changes made at the 1909 convention of the society.

Richmond's Loss on Improvement Bonds.

From a leakage in the improvement bond fund of the city, due to the failure to call in bonds when property owners had made full settlement in advance of their waiver period, and the consequent payment of interest for subsequent years by the city, it is stated there is an aggregate loss in excess of $21,000.

Under the Barrett law where property owners take ten years to pay for their assessments, bonds are issued which bear five per cent. interest. It develops that in hundreds of cases property owners have tired of the installment plan, and within a period of one to five years, have made full settlement. It also is revealed that the city, instead of calling the bonds issued against these particular assessments, has permitted them to run a full ten years, and the interest theeron has been paid out of the general fund of the city, instead of out of the pockets of the property owners.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Bituminous Filler Again.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Referring to Mr. Whitmore's suggestion on page 212 of your September number regarding my experience with bituminous filler, I will say that Mr. Whitmore has misunderstood my meaning.

We have had the same troubles that he has experienced with "ridges" due to exactly the same causes which he has assigned. They are indeed troublesome, too. But in this instance outlined in the "Bituminous Filler Story" we were very careful and the asphalt was very hot when it was poured on account of the narrow joints to be filled. Consequently, there has been no tendency to buckle or swell so far as the pavement is concerned. And the word ridge was used by me simply to give a description to the condition existing. The pavement on either side of the expansion joints has actually worn down just as if it were ground off.

If Mr. Whitmore will go with us to Erie next month to the annual meeting of the American Society of Municipal Improvements, I will try to get a section of this pavement taken up and exhibited at the convention.

E. A. KINGSLEY,
Supt. of Public Works,
Little Rock, Ark.

Concrete Pavement in Delphi.

Among the features of the September issue of the Universal Portland Cement Company's bulletin is a description of a concrete pavement in Delphi, Ind. The method of laying the pavement is herewith described in brief:

After the sub-grade had been rolled it was covered with crushed limestone which was rolled to a thickness of four inches. A ten-ton steam roller was used. Next a concrete base five inches thick was placed. This was composed of one part cement to seven parts of gravel, and the surface was left rough. Then a one-inch wearing surface of one part cement and two parts sharp sand was put on, floated with a cork float and then trowelled. After it had been trowelled it was gone over with a brush in order to roughen the surface.

To provide an expansion joint, 1 in. by 6 in. boards beveled to ¼ inch on one edge were placed every forty feet. These boards extended through the gutters. After the top had been put on, this board was pulled out and when the concrete had set the joint was filled with a tar filler which deadened the noise and kept the water from getting under the pavement.

This pavement was laid on Main street, the business street of the town, and three weeks after it was completed it was in use. In one section the experiment was tried of corrugating the surface but it was found that this was a mistake as the edges chipped off and it was found not to be as satisfactory as the method of troweling and brushing the surface.

Other matters of interest to cement users are given in this bulletin.

Concrete Covered Gutter.

To the Editor of MUNICIPAL ENGINEERING:

Sir: I have built a gutter trunk of cement and the cost is 5 per cent. less than three in yellow pine plank, and less than half the cost of brick. Reinforced top is in sections 5 feet long. The objection the Council has is the weight of the top slab, which weighs about 700 lbs. They think it will take a half dozen men to lift them. I told them I could lift it alone, without any assistance. I have a tripod lift with windlass.

W. B., Hammonton, N. J.

The sketch shows a rectangular gutter 12 by 18 inches, with 5-inch sides and bottom and a top slab 28 inches wide, 6 inches thick over the gutter, and slightly thinner over the side walls, so that the top slab cannot be slid off of the side walls without lifting it. The design is apparently good in case a gutter must be covered and the cover lie flush with the surface. If the weight of slab is considered excessive, it can be reduced by reducing the length to 4 feet, preferably; or even to 3 feet. Also, if reinforcement is well placed, the slabs are well made, and the traffic is not of two great weight or does not come on with great shock, the thickness of the slab may be reduced to 5½ or even to 5 inches. The present designs is safer, of course.

For Macadam Test Road.

Of practical interest to good roads advocates is the 1,000 or more feet of government model road, on the Rutledge pike, near the main entrance to the Appalachian exposition grounds in Knoxville, Tennesee. It was built as a part of the government's exhibit and is the type recommended as the perfect road for East Tennessee and the surrounding territory.

The treated macadam road or tar macadam is constructed up to the top surface, as an ordinary macadam road with this difference; a road bed, to the depth of 6 inches, with dirt shoulders on each side is excavated and the surface firmly rolled and prepared for the succeeding coats or surface.

The next process in its construction was the placing of No. 1 stone to a depth of four inches; second course, No. 2 stones 2 inches. The third course and fourth stage in the construction of the road is the application of an asphalt-tar mixture, followed by a light coat of screenings, which, with rolling completes the road.

The liquid mixture on the Exposition model of the Government is composed of one-third Tarvia X, donated by the Barrett Manufacturing Company, refined tar from Atlanta, Ga., and road bed oil of the Standard Oil Company. The remaining material was obtained in Knoxville at comparatively small expense.

The road, when completed, represented a comparative outlay of $10,000 per mile, constructed by the contracting firm of J. B. McTye & Sons, under the supervision of M. O. Eldridge, highway engineer of the United States office of public roads.

A Concrete Mausoleum System.

A great deal of agitation has been noted of late relative to the pollution of streams by city sewage and garbage disposal and by the refuse of riparian owners. In many cases legislation has been adopted regulating this source of menace and providing penalties for the pollution of streams which are used for public water supply. But in few, if in any instances, have there been any steps taken to guard against the poisoning of streams and springs by the drainage from burying grounds or cemeteries.

Most people are fundamentally opposed to the cremation of the dead, which, up to late years, has been apparently the only remedy for this evil. Consequently though there has been much discussion in medical and scientific papers, the old custom of inhumation is at present the most common means of disposal of dead bodies.

Much has been written and said among sanitariums concerning the transmission of diseases through drinking water, and it is now a commonly accepted fact that the bacilli of typhoid and kindred diseases may live and thrive and be transmitted through the agency of the drinking water. Hence there have been rules regarding garbage and sewerage disposal; rules against expectorating in public places; rules regarding quarantine, disinfection, etc.; but seldom has much thought been given to earth burial, the cold storage of disease.

True, there have been some who have provided vaults or receptacles for the dead; but this means has been more the exception than the custom. It has finally become necessary, in this age of advanced theories on health and sanitation, to go back to ancient customs and adopt the catacombs system to our advancement in methods of cleanliness. This system, which has been patented, bids fair to receive a great deal of attention from the cities of the future, for it provides a means of safely disposing of the dead with no consequent danger to the living.

The system has something of the catacomb idea, but in the manner of construction and the provisions for sanitation it is unique. The mausoleum system, as it is called, permits of the assembling of a number of individual crypts, ranging in number from one hundred to ten thousand. These crypts are so designed as to be entirely dry and sanitary at all times. The common forms of construction advocated are of reinforced concrete with marble finishings throughout, and with ample lighting facilities, consisting usually of skylights.

Kankakee, Illinois, has just completed one of these mausoleums which is representative in its manner of construction.

The walls throughout are of 4-inch reinforced concrete, faced with concrete block on the outside and, where exposed, with white marble on the interior. It is 125 feet by 54 feet in dimensions and has a capacity of 544 bodies. The interior is finished in white marble and is lighted by skylights covering almost the entire roof area. A dome forms the covering of a small open chapel. A rest room occupies one corner off from this space.

The crypts are arranged in tiers five high along the side on the exterior walls and six high in a center section, so planned as to give a broad passageway entirely around the interior. Each individual crypt, when the body is placed therein and the marble slab is hermetically sealed, is air-tight. In the back of each crypt and opening into a ventilation pipe is a valve which is simple in construction and of durable material. This valve opens on a pressure of six ounces and connects with an air-tight pipe running back of each row of crypts. This in turn connects with another pipe which leads to a disinfecting plant within the structure, and in a separate part thereof, and, the gases pass through a solution of formaldehyde and a cotton cushion, thence into a vent pipe which discharges at the top of the building. Thus, any gases, coming from any crypt, passing

through this disinfecting plant are made absolutely harmless. This process of ventilation and disinfecting is patented. In addition to this ventilation each crypt in its construction slopes downward at the rear or further end from the corridor, at which end is inserted a drain pipe running into the ground underneath the structure through a bed of quick lime, thus insuring further and additional ventilation and disinfection.

An endowment plan has been adopted whereby a certain sum is set aside from the purchase price of each crypt, to provide for the upkeep of the building. This endowment fund is placed in the hands of trustees whose duty it is to provide for the maintenance and repair of the structure, and who have power to select other trustees upon the condition of death or resignation.

It would seem, when this plan of disposing of the dead has been thoroughly tested and when the need for some such a movement becomes more plainly evident, that the cities should provide for their disposal rather than allow the matter to be taken care of by private interests. Why should not the cities build and maintain same such system instead of continuing to supply that institution that is so prejudicial to public health, the graveyard? It would seem that some of the care and attention devoted to maintaining drives, planting vegetation, etc., to beautifying our cemeteries, might be better bestowed upon providing a safer, more sanitary and less objectionable method of burial.

An Expansion Joint Form.

The National Construction Company, of Fond du Lac, makes use of a patented steel form for providing expansion joints in pavements. This form, which is now being used on cement street work, could easily be adapted to other forms of paving requiring a concrete base.

It consists of a metal strip about four feet in length and bent flat on itself so as to form a V-shaped cross section, tapering from an edge to about half an inch between the edges at the top. These top edges are bent over to offer a means of lifting the form. The form is about 6 inches in height and is used in conjunction with form boards. Its value lies in the fact that, owing to its tapering section, it may be easily withdrawn, permitting the removal of the form boards without injury.

A Sewer Outlet on Steep Grade in Louisville, Ky.

Among the peculiar tasks involved in the construction of the new sewerage system of Louisville, Ky., has been that of providing a new outlet structure into the Ohio River for an old circular brick sewer 11 feet 6 inches in diameter, at Thirty-fourth street. In the case of two other outlets into the river, the chief engineer, J. B. F. Breed, and Harrison P. Eddy, of Boston, the consulting engineer, devised structures for making the descent of a steep, shifting bank that is quite out of the common range of sewer construction. In the case of the Thirty-fourth street outlet, the grade to the river, 8.73 per cent, was must less steep than that of the outlet of the "southern outfall," but the problem has some other features of compensating interest. The details of the situation also throw some light on an earlier and different sort of engineering practice from that of the new system.

In connection with the various investigations which have been made of the old sewer systems, it had been found that the outlet of the Thirty-fourth street sewer, construction of which was completed in 1890, was in very dangerous condition. This outlet structure is 450 feet in length and consists of a boiler-iron tube placed in cast-iron cradles resting upon a pile foundation. The heavy load on this tube caused serious deformation and it was early found necessary to support it by means of wooden struts or props placed vertically in the center of the tube. In hopes of remedying this condition a part of this tube, where the load upon it is very heavy, was at a later date reinforced with brick masonry, carried from footings placed at an elevation about equal to that of the bottom of the tube, up and over the sewer. After making studies of different methods of reconstructing this outlet, it was decided to build an entirely new structure in a new location slightly west of the old sewer to a point a little over 100 feet further into the river than the old head-wall.

The new construction is 592 feet long, of which 506 feet is of horseshoe-shaped section with circular arch; the outlet structure proper, with the apron, is 86 feet long. The whole is of reinforced concrete, with plain, round steel bars. The outlet consists of a sewer 7 feet wide by 6 feet 8 inches high, of reinforced concrete and lined with vitrified brick to the springing line of the arch. For nearly its whole length it will be upon a very steep grade, at the foot of which there is a short outlet structure. That portion upon the steep grade was designed to rest upon reinforced concrete piles, but after the trench was opened at the upper end the soil was found to be sufficient in itself to stand the load coming upon it, and, therefore, the use of piles was omitted for a distance of 180 feet. The outlet structure was carried down to bed rock, and for a distance of 20 feet out a cut 4 feet in depth was made into this rock, and the masonry of the structure carried into it in order to give the sewer a good footing.

The reinforced concrete piles required were driven with a casing and cast-iron point. The first piles driven were at the foot of the steep grade in the sewer,

about seven feet in length. At this point there was a considerable flow of water from above, which interfered to some considerable extent with the driving of the piles. After the casing had been driven, any water within it was removed by means of a steam siphon, having a hose steam supply pipe and hose discharge. This was lowered to the bottom of the casing, the water removed, the reinforcement put in place and concrete immediately deposited. As the casing was lifted the concrete was rammed, thous forcing it into the hole and against the ground. The reinforcement of these piles consisted of four ¾-inch steel bars. The piles driven and to be driven vary in length from 7 feet to about 24 feet, and will rest upon bed rock, where it is within 20 to 24 feet from the masonry of the sewer.

The sewer has been built in three operations, the invert and side walls being first placed, then the brick lining laid, and finally the arch constructed. The outer portion of the outlet structure was flattened and widened in order that the sewer might not project anywhere above the surface of the wharf and interfere with navigation.

Water Supplies Using Compressed Air.

With reference to inquiry from "C. M. T" in your September issue, re compressed air water supplies, in the *Canadian Engineer* of April 15, 1910, is an article by F. T. McArthur, engineer at Yorkton, Man., descriptive of a plant which is in successful operation in that town. I believe this plant was dealt with further in subsequent issues. No doubt Mr. McArthur can give details.

R. D. WILLSON,
Asst. City Engineer, Winnipeg, Man.

MUNICIPAL MATTERS IN COURT

Higher Courts—Omaha Water—Compliance with Specifications.

Decisions of the Higher Courts of Interest to Municipalities.

Duty and Liability of Municipality.—As a general rule, a department of a city government, in discharging a duty primarily resting upon the city, acts as the agent of the city, although the department may have full power and authority in the particular matter, but it rests with the Legislature to determine the extent and manner in which the city shall be subject to liability for the acts of the department. An action for injuries received by reason of a defective sidewalk in the village can not be maintained against the village, but must be brought against the commissioners.—Scott v. Village of Saratoga Springs (N. Y.), 92 N. E. 323.

Contracts—Suits by Taxpayers.—Where a taxpayer, who sues to set aside a contract for the construction of a public library, under Laws 1898, c. 115, as amended, providing for the improvement of public highways, does not show fraud or corruption in the making of the contract, or the proceedings prior thereto, he must, to succeed, show that the contract is the result of illegal official acts, and it is not sufficient that the contract is unwise or extravagant.—Dunning v. Elmore & Hamilton Contracting Co. et al. (N. Y.), 124 N. Y. S. 107.

Plans—Modifications—Validity. — The original plan of the state engineer for a highway contemplated a road encircling the face of a mountain, leaving the river side of the road open so as to afford the advantages of a river view. It also involved the construction of three tunnels, 500, 105, and 65 feet long, and a steel bridge across a gully. The plan was approved by the county board of supervisors. The engineer changed the plan so as to require the road to pass through the mountain 320 feet distant from the original line, leaving the river front for a considerable part of the distance, and providing for a tunnel 1,265 feet long with no side openings, and a rock fill in place of the steel bridge. The altered plan did not provide for ventilation of the tunnel or police protection, both of which were necessary. *Held* that, though the state engineer could make changes in details in the plan, the changes made were unauthorized unless approved by the county board of supervisors, though the road provided by the new plan was shorter, and though it was not feasible to construct the road as originally planned, and though the cost of the construction of the road under the altered plan would be less than under the original plan, especially as it was claimed that the cost of acquiring the

necessary land would be greater.—Dunning v. Elmore & Hamilton C. Co. et al. (N. Y.), 124 N. Y. S. 107.

Liability of Municipality for Small Sewer.—In an action against a city for failing to construct a sewer of sufficient size to carry off surface water, thereby causing an overflow of the land of an individual, the recommendation of a city officer for the construction of a sewer, embodied in a report made to the city, was inadmissible; the city not being bound by recommendations for improvements by its different officers. A city, in constructing sewers to provide for surface waters, need not construct them so as to provide against all floods, but it must at least guard against the effect of rains which occur with frequency, if that can be reasonably done.—Kurrie v. Mayor, et al., of Baltimore (Md.), 77 A. 373.

Surface Waters—Liability.—Private persons graded and paved a private street and thereby turned the water on a public street in such quantities as to overflow the property of an individual. It was not shown that the city had accepted the private street. *Held,* that the city was not liable merely because it did not grade, pave, and place gutters in the public street, though the parties in grading and paving the private street removed a barrier which had protected the property of the individual.—Kurrie vs. Mayor, et al., of Baltimore (Md.), 77 A. 374.

Services Rendered in Violation of Civil Service Law.—A municipal corporation is not liable for the reasonable value of services rendered by employes of a department appointed in violation of the civil service provisions of the charter of the municipality.—Shaw v. City and County of San Francisco (Cal.), 110 P. 149.

Injuries from Defective Sidewalk—Claims—Necessity for Verification.—Under Medina Charter requiring a verified statement of claim against a village for injury caused by the defective condition of a street or other public way to be presented before suing, verification is essential to a valid claim, though the village be not prejudiced by no verification. Under such charter and laws a retention by the trustees of an unverified statement is no waiver of verification. Under Medina Charter requiring a statement of claim against the village for injury caused by a defective street or other public way be presented to the trustees within six months, and making failure to do so a bar to suit, the claim must be presented before a right of action accrues.—Cortiss v. Village of Medina, 124 N. Y. S. 510.

Streets—Title—Acceptance by User.—Where land was known as Rose Alley and used as an alley as early as 1862 and so continued until the issuance of a patent by the United States thereto in 1868 to the chairman of the town board of trustees, in trust for the occupants, the trust for which the town trustees took the title was to maintain it as an alley. In ascertaining whether or not a highway, park, or public place has been accepted by user, the purpose which the way, park, or place is fitted or intended to serve, must be the standard by which to determine the extent and character of use necessary to constitute an acceptance. Any user by adjoining owners of a public alley for the purposes of an alley cannot be presumed adverse to the public's right.—Koshland v. Cherry (Cal.), 110 P. 143.

Liability for Negligence of Highways.—The construction and repair of highways by a city is a ministerial rather than a governmental function, so that the city is liable for negligence therein.—Engleking v. City of Spokane (Wash.), 110 P. 26.

Defective Sewers—Failure to Remove Defect.—When a public sewer becomes clogged, and private property thereby becomes flooded, it is the duty of the municipality, when notified of the situation, to take the necessary steps to remove the clog with reasonable promptness; and for the breach of such a duty an action will lie.—Murphy v. Mayor and Council of Borough of Atlantic Highlands (N. J.), 76 A. 1073.

Improvements — Shade Trees. — The rights of the city in making authorized public improvements in the streets with proper care and skill are paramount to the interest of an abutting owner in trees planted in the streets, even though such abutter owns the fee of the street, and although the trees may be injured, and such injury might be avoided by the adoption of a different plan. The court cannot interfere with the discretionary powers of municipal authorities, and direct them to save shade trees about to be destroyed by improvements.—St. Mary of the Angels' Church vs. Barrows et al. (N. Y.), 124 N. Y. S. 571.

Excavations in Streets—Liability of City.—In an action against a city for personal injuries resulting from plaintiff's falling into an excavation made in a street, although the act of incorporation of the city may have given to the city trustees exclusive power to regulate its streets, drains, etc., yet where it appeared that for some years the city had paid the bills which were approved by the city trustees for street work done by the city marshal and had permitted him to do such work, it must be presumed that it authorized him to make the excavation in question rendering the city liable for his negligence.—Barnes v. City of Carson (Nev.), 110 P. 3.

Contracts—Competitive Bidding—Common Standard.—The board of chosen free holders under the provisions of the act of March 28, 1892 (P. L. p. 308), invited bids for the construction of a bridge according to a certain proposal, plans, and specifications that were advertised and duly exhibited to prospective bidders who were, by the proposal, required to bid "a lump sum for the whole work complete."

The proposal reserved to the board the right to require more or less work to be done under the contract, and therefore called upon each bidder to state the unit price he would charge in case of the increase or decrease in the quantity of material required. *Held,* that the competitive feature of the proposal was the bidding that was invited for the entire work as specified, and that the contract must be awarded upon the basis of such bidding and not upon estimates compiled by the engineer of the board by applying the unit prices to "a work" that differed radically from that specified in the proposal. Where there is no common standard there is no competition, and the same is true where the common standard to which a competition is invited is abandoned in declaring its results.—Browning et al. v. Board of Chosen Freeholders of Bergen County et al. (N. J.), 76 A 1054.

Waterworks Company — Contract to Furnish Water—Rates.—Under the franchise of the Birmingham Waterworks Company, it was entitled to contract with an individual to furnish water for less than the maximum franchise rate and less than the rate charged other individuals for similar service, so long as the discrimination is enjoyed solely at the expense of the company, and does not infringe on the rights of the other consumers. Where a waterworks company contracted to furnish plaintiff with water at less than maximum rates, the contract was subject to the implied provision that the charge for water should in no case be greater than the maximum franchise rate nor greater than a reasonable charge.—Brown v. Birmingham Waterworks Co. (Ala.), 52 S. 915.

Public Improvements—Formation of Districts—Enforcement of Assessment.—The creation of a district for the construction of waterworks and a district for supplying the city with electric lights is authorized, and, as the statutes do not specially prohibit the creation of one district to make both such improvements, one district may be created for the purpose of constructing waterworks and supplying the people with electric lights, unless one district, when so created, cannot be used to make both improvements. Where the complaint, in proceedings to enforce an assessment, substantially complies with the statutory requirements, and defendants do not attack the improvement district except to say that it embraces two entirely distinct improvements, the presumption is that the district was created in a lawful manner and is legal.—Wilson et al. v. Blanks et al. (Ark.), 130 S. W. 517

Public Improvements—Competitive Bids —Where an ordinance authorizing paying required that it should consist of a certain variety of asphalt which was an article of common merchandise, and of no greater price than other kinds of asphalt, and was not held in monopoly, the provision, was not void as violative of the charter provision requiring contracts to be let to the lowest and best bidder.—Cleveland Trinidad Paving Co. v. Lord et al. (Mo.), 130 S. W. 371.

Contracts — Competition. — Where the New York City board of estimate and appointment, in awarding contracts for public work, imposes only such conditions as allow a fair and reasonable opportunity for competition, the courts cannot interfere. Where, because of the steep grade of a road, it was determined to pave a portion thereof with bitulithic pavement or asphalt blocks designedly omitting smooth pavements, an advertisement for bids on such pavements presented a fair and reasonable opportunity for competition.—Hastings Pavement Co. v. Cromwell, Borough President (N. Y.), 124 N. Y. S. 388.

Ordinances—Validity—Sewer Improvement Districts—Assessments.—An ordinance creating a district to construct and establish sewers is not invalidated by a severable provision creating a district to manage and operate a sewer district. A sewer improvement assessment is not invalid because provision is made for issuing bonds, the principal of which is less, but the aggregate amount of principal and interest of which is more, than the amount fixed by the petitioners for the improvement as its cost. The assessment, however, cannot go beyond the limit imposed by the statute; in this case 20 per cent of the value of real estate as shown by the last county assessments.—Webster et al. v. Ferguson et al. (Ark.), 130 S. W. 513.

Compensation—Injury to Property—Alteration of Grade of Street by City.—The city council of Minneapolis has, under the charter of that city, the authority to establish street grades, but in making the improvement cannot take, destroy, or damage private property without compensation. The grading of a street by the street commissioner under the direction of the engineering department, pursuant to a resolution of the city council ordering the construction of sidewalks upon a grade to be "given by the city engineer" and paid for with municipal funds, is the act of the municipality.—Hallenberg v. City of Minneapolis et al. (Minn.), 127 N. W. A. 422.

Public Improvements—Liability of Officers.—The public officers who perform the physical acts required to make a public improvement, which, though irregularly made, is performed pursuant to the direction of the municipality, and is one which it is within the authority of the municipality to order, are not trespassers or personal wrongdoers.—Wallenberg v. City of Minneapolis et al. (Minn.), 127 N. W. 422.

Public Improvements — Estimate of Amount of Work Done—Authority of Of-

ficers.—A city appointed a city engineer charged with the duty of superintending the construction of sewers. Subsequently it contracted for the construction of a sewer and provided that the engineer should superintend the work in its details, and should measure the rock encountered in excavating the trenches. *Held*, that the city engineer or other officer shall have charge of the construction of sewers, etc., the official estimate by the engineer of the amount of rock excavated in constructing the sewer was a prerequisite to the validity of tax bills issued for the cost of the work, and though the engineer was not required to perform the mere clerical labor necessary to actual measurement of the rock formation, he must take the sewer construction under his personal control and apply his professional skill in securing proper measurement of the rock excavated, and that duty he could not delegate to an inspector acting as his agent during his temporary absence from the work.—Ernst et al. v. City of Springfield et al. (Mo.), 130 S. W. 419.

Cancellation of Instruments—Grounds of Relief.—Where county warrants are issued for the cost of building a bridge, the contractors guaranteeing to build it in a workmanlike manner, where the bridge collapse a year after its building on account of unworkmanlike manner of its construction, the county may maintain a suit in equity to cancel the warrants and recover the money paid on the contract. —Converse Bridge Co. et al. v. Geneva County (Ala.), 53 S. 196.

Board of Public Works—Right to Hold Office—Validity of Statute.—It is not unconstitutional for the Legislature to provide for a board of public works, composed of four persons, not more than two of whom shall be members of the same political party. The act creating a board of public works in cities having a population of not less than 100,000 nor more than 200,000 inhabitants (P. L. 1907, p. 114) is not a "private, local, or special law" affecting the internal affairs of towns or counties, within the constitutional prohibition.—Wilson, Atty. Gen., v. McKelvey et al. (N. J.), 77 A. 94.

Authority of Water Board—Charges for water Furnished City.—The charter of the city of Olean, created a city water board and a park board, and gave the water board power to establish a water system, to borrow money and issue bonds therefor to aid in the construction of the water system, to establish a scale of water rents, and provided that if the entire annual receipts for water rents, after paying expenses, should in any year be insufficient to pay the interest for that year on the loan, or insufficient, with the amount in the sinking fund, to pay any part of the principal falling due that year, the common council should cause such deficiency to be assessed and collected as other expenses of the city. The water board was further empowered to establish by-laws, rules, and regulations for the collection of the water rents and the manner of using water, and to enforce the observance thereof by cutting off the use and supply of water. The water board provided by rule that, if water rents were not paid as therein required, the supply of water should be shut off. On the refusal of the park board to pay the rate which they established for use of water by that board, the water board shut off its supply. *Held*, that, in the absence of an express provision in the charter requiring the city or any of its departments to pay water rents, the water board was without authority to charge the city or any deparment for water used. If the water board had been authorized to charge the park board for water furnished it, the remedy for failure to pay for the same would not be by turning off the water, as the supply to the park board was to meet a public necessity, and should not be interfered with.—People ex rel. Johnson et al. v. Barrows et al. (N. Y.), 124 N. Y. S. 270.

Public Improvements—Materials—Lien for Labor.—Under Lien Law, giving a lien for the value or agreed price of labor performed or materials furnished for the construction of a public improvement, a lien may not be acquired for the use or rental of a steam shovel for use on the work, where the person claiming the lien did not perform any labor in connection with such use, though the implement was hired by the contractor specially for use on the work.—Troy Public Works Co. v. City of Yonkers et al.; Warren v. Same (N. Y.), 124 N. Y. S. 307.

Decree in Omaha Water Case.

As a result of the hearing on a proposed decree which the city sought to have signed against the Omaha Water Company in the waterworks case, argued in United States Circuit Court, the city of Omaha, when it takes over the plant will be compelled to pay interest upon the appraised value of the plant from August 9, 1906, an amount totalling almost $2,000,000, and in return will receive the net profits of the plant from that date until the time it is taken over.

Early in the hearing the attorney for the water company offered a decree which he proposed to substitute for the one asked by the city. This in substance, would order the water company to turn over to the city all the profits which the plant has netted it since the deed was offered the city in 1903; would order the property near Krug park, on Burt street and near the settling basin in Florence, to the title to which there is objection on the part of the city, be exempted from the purchase and a corresponding reduction in the appraised price

made, and would compel the city to pay the appraised price with interest at the legal rate from the date on which the water company claims to have offered it a sufficient deed to the property. This was objected to upon the ground that the company had no right to exempt the city from the purchase of the property in question, contending that that matter was one for the city itself to settle. The decree which the city had asked to be granted and which provided among other things for the submitting by two New York trust companies of the mortgages held against the water company by them, was objected to on the ground that the court had no jurisdiction over these companies and hence it would be impossible to enforce such a decree. The judge also gave it as his opinion that it was the duty of the court to see that the trustees of the mortgages upon the plant discharge them. He ordered an accounting of certain materials included in the company's plant and for that purpose appointed a special master in chancery.

Railway Company Must Comply with Paving Specifications.

In a sweeping decision which completely wipes out all quibbling by the Springfield Railway Company in the matter of making desired improvements in the manner of paving streets in Springfield, Ohio, Judge Albert H. Kunkle held in his opinion in the street railway paving case that the city had the legal right under the company's franchise to demand any reasonable construction as a base for the tracks when paving South Yellow Springs street.

The decision reflects a complete victory for the city in the much-debated question as to whether the officials could compel the railway company to lay a base of six inches of concrete beneath its ties instead of gravel as has been the company's custom.

Judge Kunkle held that while the new specifications employed by the company since January 1, explicitly contain this provision, the same proposition is also covered in the former specifications that cover the South Yellow Springs street paving contract. Provisions for a subbase of 6 inches beneath all of the pavement appear in the specifications. The court held that this did not mean a portion of the pavement, but beneath the entire structure, regardless of any ties that may be installed by a railway company.

The company will take no further steps to stop the progress of the work pending a satisfactory entry can be drawn up which will reserve the right for the railway company to contest the payment of the expense connected with laying the extra concrete between the ties. Between the ties, if the city's plan is followed, there will be 12 inches of concrete and this imposes an extra burden of expense upon the railway company about which there will be some question as to whether the company or the city is liable for the payment.

CURRENT INFORMATION

Education by Street Railroad—City-Owned Car Line—Coal Dust Explosions—Municipal Land—Washington Parks—Public Service Commission—Fuel Specifications—Concrete Coast Defenses—Edison Houses.

Public Education by a Utility Corporation.

The Southern Wisconsin Railway Company, of Madison, Wis., believes in talking its troubles over with that often neglected factor in municipal railroading, the public. For this purpose the company expends each month a certain amount to set its ideas before the people through the medium of printer's ink, in the following manner.

For one week of each month a half page is reserved in each of the papers of the city of Madison for use by the company. Then the material so used is printed in the form of hand bills which are tied in bundles at either end of each of the cars operated by the company. The subject matter of these articles is of a widely divergent scope, but, of course, pertaining always to the management, use, problems and troubles of the company. Articles by prominent men in electric railway lines, court decisions, comment from magazines of note and such matter forms the bulk of the material used. The company puts the proposition in this light:

We believe in advertising and we think the papers are second only to the street cars for that purpose—we carry from 8,000 to 12,000 people each day with as little friction and as few accidents per passenger as can be found in any similar city in the United States. We

have a firm conviction that the people are entitled to know both sides of every question, which, as final arbiters they are called upon to settle—in order that we may get at all of the people through the two best mediums we shall use both the newspapers and the cars, and through these mediums we shall present such matters as are of interest to you and concerning which you should be well informed.

But perhaps there are some who will still contend that the procedure is only due to a desire to secure more lenient legislation, rather than a desire to enlighten the public in what it should know.

City-Owned Car Line Pays.

Municipal ownership and operation of a street car system has proved remarkably successful in Belfast, according to Consul Henry B. Miller. To students of municipal ownership problems there is special interest in this subject.

Low cost of transportation, economy of administration and lack of accidents are points chiefly emphasized by Consul Miller, explaining the success with which Belfast has run its own street cars. The regular fare there is 2 cents. One of the unusual features of the system is the concentration of all lines through a general central station which makes every part of the city accessible from that center.

Belfast took over the street car system of the city about five years ago. Its head is a general manager selected by the city council.

The Explosibility of Coal Dust.

The recently created Federal Bureau of Mines has just issued a bulletin on the explosibility of coal dust, with chapters by J. C. W. Frazer, Axel Larsen, Frank Haas and Carl Scholz. The bulletin was prepared by the Technologic branch of the United States Geological Survey, which is now a part of the Bureau of Mines, and therefore will be known as Geological Survey Bulletin 425, but will be distributed by the Bureau of Mines. The author of the bulletin, George S. Rice, chief mining engineer of the bureau, goes fully into one of the most serious and most perplexing problems that the coal mines have had to contend with in the last few years. He traces the growth in the belief in the explosibility of coal dust, summarizes the experiments and mine investigations that have established this belief and gives the present status of preventive measures.

In the introduction, Mr. Rice says: "Only within comparatively few years has the dry dust of bituminous and lignitic coal been generally recognized as an explosive agent more insidious, threatening and deadly to the miner than firedamp. Firedamp carries its own flag of warning, the 'cap' in the safety lamp, but coal dust, though visible, does not attract attention until present in large quantities."

Mr. Rice reviews the experiments into the explosibility of coal dust in foreign countries and dwells at considerable length upon the attitude taken in France by the engineers, who, until the great disaster at Courrieres in 1906, which cost 1,000 lives, did not believe that coal dust would explode without the presence of firedamp. Mr. Rice concludes by reviewing the various remedies that are offered for the coal dust problem, giving the good and bad points of each.

This bulletin may be obtained by addressing the director of the Bureau of Mines, Washington, D. C.

Municipal Ownership of Land Profitable.

In a report offered as chairman of the committee on parks, playgrounds and school of New York City, Alderman Campbell offers figures to show that municipally owned land is very profitable.

Nearly all land bought by the city before 1850 has increased unbelievably in assessed valuation, admittedly below the market price, over the original cost. One case of nearly 9,500 per cent, increase within the last sixty years was found, several cases of from two to five thousand per cent. increase in the last seventy-five years, ninety-five cases of over 500 per cent increase, and nearly three hundred of over 100 per cent. The city owns in all 943 sites.

Alderman Campbell notes that Berlin owns one-tenth of the land within its own limits. Vienna about one-seventh, Munich one-fourth and Frankfort-on-Main about one-half.

Action Urged in Washington Park Plan.

Urging that the commissioners send Congress proposed legislation for the construction of a park system within the District of Columbia, M. C. Hazen, District surveyor, gives warning that unless something is done quickly many sub-divisions will be made and improvements placed thereon so that the ideas in certain features of the great proposed park system will be entirely frustrated. The warning is embodied in a report of the year's work of the surveyor's office sent to the commissioners August 31.

During the last session of Congress authority was given under public act No. 170, approved May 10, 1910, authorizing the commissioners to condemn and acquire fee simple and absolute title, including all riparian rights, to a strip of land for public highway and for park purposes along the Anacostia river from Monroe street to Giesboro point.

Mr. Hugh T. Taggart, special counsel on the ownership and riparian rights along the Anacostia river, in his report to the commissioners holds that the

United States owns to the high-water line along the shore of the Anacostia river. It is therefore very important that these lines be accurately determined by an official survey.

This high-water line is receding rapidly. Where it was once water it is now left dry, and should, under Mr. Taggart's opinion, belong to the United States, but as filling and accretion is going on along the bank of this stream very rapidly, thereby shifting the water line and obliterating the original shore line, it allows owners of adjacent property to include new areas in their holdings.

Maryland's Public Service Commission.

After a great deal of controversy and newspaper agitation, the state of Maryland has adopted an act providing for a public service commission similar to those of other states, notably Wisconsin. The commission created under this act is vested with supervision of every class of public service corporation in Maryland. In defining "common carrier" the following classification is given:

All railroad corporations, street railroad corporations, express companies, car companies, sleeping car companies, freight companies, freight line companies, steamboat, power boat, and vessel boat, and ferry companies, canal companies, and all persons and associations of persons, whether incorporated or not, operating such agencies for public use in the conveyance of persons or property with this state, by land or by water, or both.

In a similar specific manner gas corporations, electrical corporations, telephone, telegraph, water, heating, and refrigerating companies are defined and brought under direct jurisdiction of the commission.

The field of control of the commission is so broad in fact that it seems as though it were intended to give jurisdiction over all matters pertaining to character of service, rates charged, capitalization of companies of all sorts and conditions of public service corporations, or associations, or individuals which in any capacity supply the services indicated. In addition, franchise grants to new companies are made subject to the approval of the commission.

The commission consists of three members appointed by the Governor, one of whom is named as chairman at the time of his appointment. The only qualification for office is that the appointees shall be legal voters over 25 years of age and shall not hold any official relation to any corporation or company coming under the jurisdiction of the commission; nor shall they hold any stock nor have any interest in any manner in the corporations specified. The commissioners hold office for 6 years, a new one being appointed at the end of each two years. The salaries are $6,000 for the chairman and $5,000 for each of the other members respectively, half of the chairman's salary and two-fifths of that paid to each of the other commissioners is to be paid by the City of Baltimore; but no provision is made for specific services to be rendered to the City of Baltimore different from those given to any other city of the state.

Provision is made for investigation by the commission of "the cause of all accidents on any railroad or street railroad resulting in loss of life or injury to persons or property, and which in its judgment shall require investigation." All railroads and street railroads are required to notify the commission of every accident occurring on their lines. Provision is made for a uniform system of railroad and street railroad accounting, conforming as nearly as may be to those of the Interstate Commerce Commission.

Full authority is given the commission to investigate the quality of service rendered by any corporation, and in case of need to prescribe such changes on modifications as may be necessary. Full power is given to set standards, designate tests, and to require the fulfillment of such provisions.

The commission is also given "full and plenary power to value the plant, property, appurtenances, assets and franchises" of corporations under its control and to "prescribe uniform methods of keeping accounts" and records of all such companies. Complaints regarding the quality and price of gas and electricity may be made to the commission by municipal authorities, or by 100 customers, whereupon the commission must make an investigation and finding and issue orders accordingly.

Two peculiar features of the Act creating the commission have caused some comment. The first is that providing that the offices of the commission shall be open from 8 a. m. to 9 p. m. every day in the year, with one or more responsible persons in charge. The other fact that is occasioning comment is that no provision is made for retaining an engineer, though clerks and others are provided for; in most cases they are chosen by the commission subject to the approval of the Governor.

Protest Against New York's Fuel Specifications.

The Black Diamond, the official organ of the coal industry, has addressed an open letter to Mayor Gaynor, protesting against the recently adopted specifications for coal to be furnished to the City of New York.

The first provision to which exception is taken is that providing that all coal shall be purchased on the B. t. u. basis. New York uses principally anthracite coal, and purchases this through retailers. The producing companies resist the sale of coal on the B. t. u. basis, so that the provision objected to imposes a condition on the middleman, which he in turn cannot transmit to the wholesale dealer.

The paragraph providing for a check analysis does not give to the contractor the right of having a representative present when the city makes such an analysis, and, in fact, gives no assurance as to the competency of the persons making the tests.

Exception is taken to the requirement that all coal wagons shall be sealed so as to prevent loss or abstraction of coal after the wagons have been weighed. This objection is made on the ground of extra labor and expense in sealing the 500,000 tons of coal delivered to New York City annually.

The greatest objection voiced in this protest is with regard to "Corrections of Gross Tonnage," which provides corrections as follows:

For the percentage of moisture in excess of the allowed limit, proportionate deduction.

One per cent. for each per cent. of ash in excess of a standard analysis.

One per cent. for each one hundred B. t. u. below standard heating value.

Five per cent. for each one per cent. of volatile sulphur in excess of a standard analysis.

Two per cent. for each one per cent. of volatile combustible matter present.

Payment will be made only on the net tonnage after these deductions have been made.

The Black Diamond protests that in paying for heat units on the B. t. u. basis there is nothing paid for foreign matter. In deducting for impurities a double penalty is enforced in that the contractor has to stand for the increase in impurities and the consequent decrease of heat units. The clause relating to the ash is objected to, but it is stated that such a clause is customary, though unjust.

Further objection is made to the statement providing that "excessive clinker or prohibitive amount of smoke shall be cause for the condemnation of deliveries of coal." It is stated that this provision makes the contractor responsible for conditions in the firing room, for clinkering and smoking can be avoided by proper firing.

It is stated that the intention of the specifications was to save money to the city. The opposite result is expected, for it is said that the contractors will be obliged to raise their prices to provide a margin of profit to cover their risks in meeting such rigid specifications.

Concrete Coast Defences.

Recent tests at Sandy Hook of the resisting power of reinforced concrete as a defense against high-powered projectiles confirm the calculations of the penetrating power of the twelve-inch gun. A concrete wall twenty feet thick, heavily reinforced with steel beams, was pierced by a twelve-inch projectile fired at high velocity. The blow delivered was sufficient to penetrate twenty-two inches of armor plate, and the reinforced concrete withstood the attacks so well that it will probably be used in the construction of the new coast defense fortifications in the Philippines.

The Edison Poured Cement Houses.

One feature of the Cement Products Exhibition to be held in Madison Square Garden, New York, on December 14-20, 1910, is to be an exhibition of the pouring of cement houses according to the Edison plan.

The plan upon which Mr. Edison has been working is briefly, the completion of a set of steel molds which can be used time after time in pouring houses. It is said that the great inventor has produced a mixture of a consistency almost like water which holds the aggregate in suspension, allows the mixture to flow freely to all parts of the molds and secures a uniform distribution of the concrete throughout. The molds are capable of variations of arrangement, making possible different styles of houses from the same set of molds. With a half dozen molds, therefore, a wide diversity of styles will be possible.

Mr. Edison and his engineers claim that such a house can be built for $1,200. It is intended for one family, is to be built on lots about 40 ft. by 60 ft., and has a floor plan 25 ft. by 30 ft. There is an 8-ft. porch in front and a small rear porch. The house is not to be of plain panels, but will have considerable exterior ornamentation. The ornaments will be cast with the house and will be reinforced concrete, including the roof, floors, inside walls and stairs.

Mr. Edison proposes to erect the molds for such houses in four days. After the molds have been assembled, the time allowed for pouring the concrete is six hours. Fourteen days after the pouring the house is complete. It is estimated that with six sets of molds, one hundred and forty-four houses can be built in a year, the forms being used indefinitely, thus reducing the cost to a minimum. A complete set of molds is to cost approximately $25,000.00.

That this idea of pouring cement houses is destined to play an important part in the industrial world is already evidenced by the action of the American Sheet and Tin Plate Co., in building two hundred workingmen's houses of concrete at Gary, Ind., using a set of steel molds which are of their own design and construction. The plan is strikingly similar to the Edison idea of pouring houses.

WATER WORKS

Houston Water Works—Water Waste—Storage Reservoirs—Somerville Water

Houston's Water Works System.

During the past year the city of Houston, Tex., has awakened to the extensive waste of water by private consumers. This waste was a very serious factor inasmuch as the source of supply is an artesian well system and not inexhaustable.

As the first step toward preventing this useless waste of water the city adopted the plan of metering the water furnished to the big consumers, and so successful did that plan prove that a general order was issued to meter all connections, including the railroads and other big concerns. The work of installing the meters is now in progress, and it is expected before the lapse of another year that the entire city will be metered.

In connection with this installation of meters an ordinance was passed by the city commissioners authorizing the sale of water meters to consumers on the monthly installment plan, the meter to become the property of the consumer as soon as a certain amount is paid to the city to cover the cost of the meter and expense of installing it. Less than 18 per cent. of the total number of water consumers were supplied through meters on March 1 of this year, and from that small percentage a saving of more than 40 per cent. in per capita pumpage was noted. Since March 1 many additional meters have been installed, with the result that the pumpage has shown a greater reduction.

During the last fiscal year of the city, which ended February 28, the total consumption was 3,197,477,010 gallons, making an average daily consumption of 8,760,211 gallons, or a total of 87.6 gallons per day to each inhabitant, based on a population of 100,000.

The water that passed through meters measured 415,672,011 gallons. The cost of supplying water per 1,000,000 gallons, figured on maintenance, was $22.33, while the total cost per 1,000,000 gallons figured on maintenance and interest was $39.45.

Since the beginning of city ownership, October 1, 1906, the per capita pumpage has been reduced from 155 gallons to 85 gallons per day, a net saving of 43 per cent., with less than 18 per cent. of the consumers supplied with meters at that time. It is believed that with the installation of additional meters the waste will be eliminated and the per capita pumpage cut down to about 60 gallons per day, which is deemed an adequate amount to supply the city for all purposes.

At a cost of $112,532.56 the city during the last fiscal year installed 4,423 feet of 24-inch, 8 feet of 20-inch, 12,418 feet of 12-inch, 76,372 feet of 8-inch and 32 feet of 6-inch mains, making a total of 93,253 feet and giving the city a system of 94.6 miles, an increase of 23 per cent. over the previous year.

The rapid growth and development of the city made it necessary for the city to extend many of its mains during the present year. These extensions were made in localities where fire protection and pure water for general supply were needed and, incidentally, where the general circulation of the system could be improved by connecting dead ends and low places.

The problem of pumping capacity was solved when the 15,000,000-gallon pump was installed last November, thereby doubling the capacity of the plant.

A new system is under consideration and the site for it has already been secured. Upon this property there is situated a large lake, which the city proposes to use as a storage basin, keeping it well supplied at all times with water from artesian wells.

Consulting Engineer F. L. Dormant has been instructed by Mayor Rice to prepare plans for the proposed new water station and for a system of new mains to be used in supplying high pressure.

Waste in Water Works Due to Fire Protection.

Depletion of the lumber supply attracts much attention. We imagine Uncle Sam discusing it earnestly, even passionately; then lighting his pipe and absently dropping the match in the wood box. The country produces five hundred million dollars' worth of lumber a year and burns up eighty million dollars' worth of frame buildings—and seventy million dollars' worth of contents, to show that it has no prejudices in the matter. The annual fire loss—largely preventable—amounts to two dollars and a half for every man, woman and child.

The huge cost of the fire protection required by the prevalence of wooden buildings, bad construction, and carelessness is strikingly suggested by the fact that there is a total of more than $150,000,000 tied up in the mere value of the metal of the fire hydrants and their supply pipes of our cities. Fire service requires water works equipment valued at

$245,671,000; and the annual expense of the fire protection portion of the public water works systems is just under $29,000,000.

Large totals, however, may be large without giving the average man any clear idea of what they mean. We are used to big totals, on all sorts of topics. Metcalf & Eddy, civil engineers of Boston, have therefore done a good service to better understanding of the fire loss by constructing a table which shows the proportion of the outlay for different parts of water works systems that is chargeable to fire protection. This table is based on the totals given in a recent bulletin of the United States Geological Survey.

Metcalf & Eddy's table shows that of all the money paid for sources of water supply, fire service is responsible for about 11 per cent. This does not seem extreme, for obviously no very large amount of water, in comparison with other uses, will be needed for putting out fires. The distributing mains and pipes of the fire system absorb 27.2 per cent. of the cost of the whole distributing system; while 28.4 per cent. of the total tons of pipe are devoted to fire service. For the whole country, fire service in the water works systems is responsible for 22 per cent. of the total outlay. The Metcalf & Eddy table shows further that the fire service is proportionately less costly in the largest cities. The percentage on all three of the items named above is below the average in cities of 100,000 inhabitants and over. It rises, generally speaking, as cities become smaller, and is furthest above the average in cities of 5,000. This suggests that small cities, which are the least insistent on fire-resisting buildings, might do well to adopt the restrictions that are supposed to be necessary only in large cities.

Water Storage Reservoirs.

The State Water Supply Commission of New York has issued a pamphlet in which the construction of storage reservoirs by the state is strongly advocated. The benefits to be derived from the construction of such reservoirs are described at length and may be briefly summarized as follows:

(1) The equalization of stream flow by storing the water during wet seasons and using the same to increase the volume of the stream through dry seasons.

(2) A consequent large increase in the power value of the stream, due to augmenting the low water flow, and thus doubling or trebling the dependable flow for power purposes.

(3) A consequent decrease in the height of freshets, thereby reducing the great pecuniary damages caused by the periodic recurrence of floods.

(4) By increasing the low water flow of polluted rivers a dilution would result which would improve the sanitary conditions on the streams.

(5) Navigation would be benefitted by a higher stage of water on the lower reaches of the river.

(6) The extension of transportation facilities, often to an important and desirable extent, by navigation on the proposed reservoirs.

(7) The low lands of the river valleys could be made somewhat more tenable, and their agricultural products increased by reducing the contingency of floods.

(8) The perpetual submergence of extensive tracts of swamp lands, which are now unsightly and a menace to health, would be possible.

(9) The creation of extensive lakes with beautiful shores offering desirable locations for permanent homes, and great attractions to summer visitors seeking recreation and health.

(8) Inestimable indirect benefits to the state due to the stimulation of industrial enterprises; the increase in number and prosperity of the people, and the creation of taxable wealth by the progressive development of water powers.

The Water Supply Commission as a part of its last annual report to the Governor and Legislature submitted a bill providing for a systematic development of the waterpower resources of the state under state control. This bill contemplated the return of a net revenue to the state and accordingly provided for the assessment of benefits upon individuals and properties benefitted by reason of the construction and operation of storage reservoirs. Many of the provisions of this bill were new in principle and it was to be expected that a measure of such far reaching effect would meet with some opposition. Although the bill provided for contracts to be entered into with respect to payments for benefits to be conferred and the power of assessment was only to be resorted to in order to forestall an unwilling beneficiary from blocking the progress of a great public enterprise, such a provision met with disapproval in the Legislature and the bill was not advanced. The Commission believes that as the Legislature becomes more familiar with the problems involved, it will approve of this policy. For these reasons, the bill with amendments in other respects will again be submitted to the Legislature in connection with the next annual report.

Numerous complaints have been filed with the Commission alleging unsatisfactory domestic or fire service both on the part of municipalities and water companies. The source of dissatisfaction seems to be the lack of foresight on the part of the municipal or water company officials as a result of which they have obtained an inadequate supply or insufficient pressure. These complaints seem to indicate the need of some supervision of such departments by the state and it

is probable that such control will be assumed in the future.

Water Supply of Somerville, N. J.

Mr. Nicholas Hill, consulting engineer, has offered a report on the solution of the water supply situation in Somerville, N. J. Mr. Hill was employed after a mass meeting of citizens of Somerville last month, and has since been engaged in making surveys covering a radius of 15 miles around that city.

The citizens of the borough at the above mentioned mass meeting voted an appropriation of $2,000 for the investigation, and the consulting engineer, through a special committee of the Borough Council, presented a report on the sources of water supply in Central New Jersey that are not pre-empted. One interesting feature of the report is that a mysterious water syndicate has captured about every source of supply in that section that is not pre-empted, by acquiring mill rights along all the tributaries of the north branch of the Raritan river, and the borough will have to pay the syndicate damages for mill rights in obtaining its water supply. All this the engineer figures in on the cost of a municipal plant.

The syndicate has spent ten years in quietly buying up these mill rights, but in the secrecy which it has observed in guarding its plans for capturing the Raritan and its tributaries for a great water supply it has failed to declare its intention in detail to the State Water Commission, and in this particular it has been forestalled by the borough officials, who have served notice on the State Water Commission that they are now surveying the north branch and its tributaries, with the object of condemning a water supply of 4,000,000 gallons a day for the borough.

The project recommended by the special committee of the council is that of obtaining a supply from the north branch of the Rockaway river at Mountainville, a distance of 13 miles from the borough. This is reported to be the best water supply in the state.

Exhaustive tests have proven the water to be of such purity and softness that it will not need filtering. The supply can be brought to the borough by gravity and will need no pumping stations, and at the same time there will be a pressure of sixty-two pounds in the mains, which will be adequate for fire purposes. The estimated cost of a great concrete dam at Mountainville and a plant that will provide for the borough for the next twenty years is $370,000.

The other sources of supply proposed by the engineer are from the North Branch river, near North Branch, at a cost of $218,000; from the Black river, near Pottersville, at a cost of $23,200, and from sunken wells near the Raritan river at Finderine, at the cost of $40,000, but all of these projects will require pumping stations and filtration plants, which will greatly increase the cost of operation and produce an inferior quality of water.

LIGHTING

Philadelphia Electrical Bureau—Mukden Lighting Plant—Broadways and Brightways—Flow of Gas—Pasadena Lighting Plant

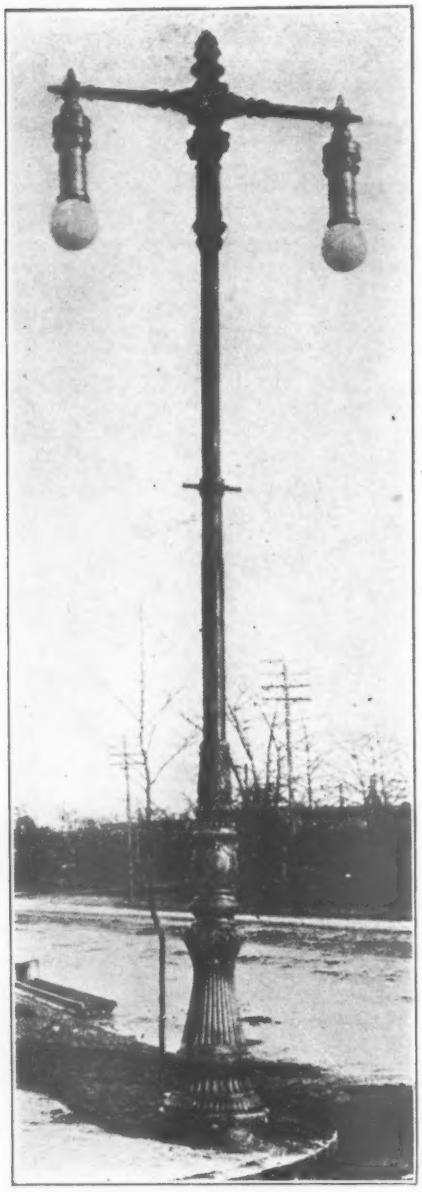
The Electrical Bureau of Philadelphia.

The growth and development of electrical devices for quick communication, and the application of these to the workings of municipal affairs, has made the electrical bureau one of the most important departments in municipal management. To such a bureau if properly managed is due the credit for quick and efficient work in the departments of fire and police protection; and further, the safety of the public is guarded by a proper inspection of wiring, street signs, moving picture shows, etc. A recent number of "Philadelphia" gives an account of the electrical bureau of that city.

All the electric lighting of the city streets, represented by 12,305 arc lights is under direct supervision of the bureau. It is the bureau's duty to pass upon construction and power of lamps and to see that service is maintained under conditions of the contract. It also has supervision of electric lighting and power installation work in private homes and business buildings through its control and supervision of the whole system of underground and overhead wires, and is charged with the duty of inspecting all places of amusement where electrical lighting is used.

In its hands is placed the great responsibility of providing and protecting a system of telephone and telegraph communication so complete in all details that the handling of fire danger becomes a science, and safety of life in the home section and property in the business sec-

tion is reasonably insured. The electric wiring which makes possible operation of 650 miles of rapid transit facilities comes under the supervision of the Electrical Bureau, so that even the incident of con-



ORNAMENTAL LAMP-POST
PHILADELPHIA.

veyance from home to business depends in a measure upon its vigilance.

The mere enumeration of the various lines of activity under direction of the Electrical Bureau should, in itself, carry a convincing message to the mind of all concerning the importance of its work, but when these various activities are analyzed their importance becomes more clearly established.

Take, for example, the service performed in connection with the police and fire departments. Signals from the fire-boxes located throughout the city, and messages over the police telephone, aggregated last year 6,848,701 separate communications between outlying districts and headquarters. This means that every five seconds, in every hour of every day and night, during the year 1909, a communication, important in character and affecting the well-being of the citizen, was transmitted over the city's system of wires. A failure in the transmission of any one of these seven million messages might have resulted in serious loss of life or property, and yet not one failure in service occurred during the whole twelve months.

Philadelphia is the only city in the country which has direct wire connections between police headquarters and all pawn-brokers' establishments. By means of this system of instant communication with places where thieves generally make their first effort to dispose of stolen property, the officials of the city are able frequently to secure a criminal at his first effort to realize on goods stolen, because notification of theft and description of property can be placed in every pawn-broker's office within five minutes after the robbery has been notified at the nearest police station, although that station may be ten miles from headquarters.

The Electrical Bureau also designs permanent illumination features for parks and public buildings as well as all of the smaller fixtures for use within the city hall and other city buildings. In fact the Electrical Bureau, in addition to its general direction and care of electric work, originates nearly all of the designs used in all branches of the work and many of its most important facilities are under patents which originated with the bureau. In this matter of office designing, or the more ambitious planning for large outside work, there is indicated an important division of the bureau's responsibility little appreciated by the general public. Take the following incident as an illustration:

One of the most important pieces of work confided to the supervision of the Electrical Bureau of late years has been that of relighting Philadelphia's business center. After a careful investigation of lighting methods followed in other cities in this country and abroad, it was determined to inaugurate a new system of ornamental lighting to cover the heart of what was the original city.

To this end the chief of the bureau called into consultation the architects of the city and members of the T Square Club identified with that profession, sub-

mitting to these representative men plans and specifications, with a view to organizing a competition in connection with the designs for the new electric light poles. Upon the advice of these high authorities it was decided that the design for the poles should be made the subject matter of a contest in the forthcoming competition for the Cope Memorial Prize, and designs for this competition were submitted and hung in the exhibition rooms of the Academy of Fine Arts. The design which won first prize in this Academy of Fine Arts competition was the one adopted by the city and erected on the city streets. An accompanying photograph shows the type of arc light pole adopted. The design was awarded the Cope Memorial Prize, and the plans and specifications were prepared by the Electrical Bureau.

The chief of the Electrical Bureau has since established a museum at City Hall showing all methods of lighting now in use, with a series of lamps illustrating lighting methods running back more than 3,000 years. Perhaps the most gratifying feature of the administration of the city Electrical Bureau is that it is practically self-supporting, license fees collected and rent paid for city ducts and cables providing a revenue 10 per cent. greater than its entire payroll, while the city receives free electric lighting service valued at $75,200 a year.

The Light Plant at Mukden, Manchuria.

The Far Eastern Review contains an account of a municipal light plant in a country that is usually considered to be among the "benighted." The movement towards obtaining this plant was started in 1908 under a coterie of public officials of which H. E. Zang Shaoiji, governor of the province, was leader. Under this administration an appropriation was made for a lighting system for Mukden; it being proposed to furnish light for the government yamens and streets.

The first plans called for a rather limited plant, as commercial lighting seemed rather hopeless at first, owing to the cost, and the fact that all shops close at sundown and the inhabitants as a rule retire very early.

In building the plant and constructing the lines a great many peculiar conditions were encountered, and new problems are constantly being met.

Due to the number of poorly constructed telephone lines and the inflammable interior walls and ceilings of houses, special attention and extra precautions have been taken to protect all circuits with enclosed safety fuses. Double the number of fuses that are used in American or European practice have been placed in the circuits. Wires of ample size have been used and special efforts have been made to securely fasten wires to insulators. The poles are set deep and are well guyed, and strong cross-arms with iron insulator-pins support insulators designed for a much higher voltage than that in use.

The entire work of installation was completed with remarkable celerity. The engineer of the General Electric Company, who had the matter in charge, arrived in Mukden the first of July, 1909, and began the organization of several gangs of workmen and drew plans for power station and pole line arrangements. House wiring was started in the government yamens about August 1, and the erecting of power station machinery August 15. The plant was given a twelve hours test run on September 30, and put in operation with about one thousand lights, October 3. The G. E. series tungsten street lighting system which was put in operation in November, shortly after the arrival of another shipment of equipment, has been generally approved by the officials and public, and is giving every satisfaction, as it is peculiarly adapted for the streets of a Chinese city.

The following data are in brief descriptive of the present plant:

Normal capacity of present plant, 5,000 lights—16 c.p.; lights in operation, 5,000 —carbon; street lights, 60 c.p., 300 series tungsten; miles of streets lighted, 10; miles of pole line constructed, 23; miles of wire on poles, 70; capacity of line wires, 20,000 lights; transformers installed, 62; capacity of transformers, 8,000 lights.

Shortly after putting the plant in operation the management was convinced that it would be loaded to its capacity before the following spring, and arrangements were made for its extension. Owing to the high cost of fuel, the most efficient machinery is the most economical and it was decided to install a 600 h.p. Curtis steam turbine driving General Electric dynamos of 400 kilowatts capacity. To add to the reliability of the plant, a separate small turbine-driven dynamo of 20 kilowatts capacity was installed. The steam from the turbines is condensed in Wheeler surface condensers under high vacuum held with electric motor-driven pumps. The condensed steam is pumped direct to the boilers and used continuously. Babcock & Wilcox boilers of the latest design were installed and equipped with automatic mechanical stokers. A super-heater is integral with the boilers to eliminate the danger of water in the steam. The boiler capacity is sufficient for the two turbines. The present system has a capacity of 12,000 lights.

Although power for lighting is sold by meter cheaper than in other cities in China, the receipts for lighting service have considerably exceeded expenses from the start, and with the plant completed, the receipts will cover operating expenses and cost of extensions, and leave a reasonable profit on the invested capital, while the increased demand not only for

lights, but for heating and power equipment seems to assure the success of the Mukden plant.

Broadways and Brightways.

The above is the phrase chosen to designate the cluster-light street lighting system of Indianapolis, as a result of a competition conducted by the Indianapolis Commercial Club. The contest was instituted some months ago and attracted a great deal of attention, as over 2,500 suggestions were submitted to the committee of judges.

Many of the contestants sent letters explaining the good points of their suggestions. Some of these were in verse. Some were convincing—others not. But all were interesting and worth while.

Phrases which included the word "way" predominated, there being nearly 100 of these. "Trail" was also a favorite, and "road" had many to urge its availability. Almost every word which could be associated with light was used in some form or other.

Just to give an idea of the way the suggestions ran, a number of them, selected at random, follow: Aurora Indianapolis," "Thoro-lighted," "The Comet's Tail," "Chantecler," "Strands of Sunshine," "Tungstolight," "Sol's Substitute," "The City Brilliant," "The Brite Lites," "Luminar Place," "Moon Pike," "Shino-Way," "Firefly Promenade," "Pearls on Poles," "Five Light District," "The Great Light Way," "Sparkle Avenue," "Gloom-No-More," "The Nineteen-Hour-Every-Day-Spot," "Blocks of Five," "The Milky Way," "Sunshine Alley," "White Streak," "Golden Glow," "De-Lightful," "Glow Worm Walk," "Path o' Pearls," and Indianapolite."

Letters and suggestions were received not only from Indianapolis, but from all quarters of Indiana, from Colorado, California and many other states. The suggestions were copied and numbered so that the committee did not know the name of the winner until after the choice had been made. The number of suggestions received indicates the popularity of the new system.

Flow of Gas in Pipes.

Professor E. A. Hitchcock of Ohio State University and Samuel S. Wyer, M. E., made recently a report on natural gas service rendered the city of Columbus, O., which contains much material of value in the investigation of the operation of both natural and artificial gas plants. The discussion of the flow of gas in the main transmission line is abstracted as applicable to any gas main. The results were obtained by the use of the most approved apparatus and the variations in rate of flow of gas in various parts of the cross section of pipes were determined by means of Pitot tubes. Following are the paragraphs regarding the determination of the flow of gas in the main transmisison line:

The main transmission line, which connects the pumping station with the city of Columbus, has a nominal diameter of 10 inches and a total length of 26.2 miles. It was the intention to investigate the flow through this line under different conditions of velocity while the pumping station was in operation. This we were unable to do until the station was closed down, when the flow was maintained by the pressure of the field.

A second Pitot instrument having the same form of tips as the one used on all work was connected to the transmission line .2 mile below the pumping station, while the traversing instrument was connected to the line just above the main gate valve at the Fifth Avenue measuring station at Columbus, making a distance between instruments of 26 miles. Thermometers were also inserted in the line at the two points. The pressure gauges used on the Pitot instruments were calibrated before and after the tests, and every precaution taken so that the results obtained for quantity of flow at the two points would be absolutely comparative, and therefore the difference shown would be the line loss due to leakage for the pressures prevailing at the time. A series of readings were taken the evening of July 6, followed by another series beginning at 6 a. m. on the following day. The demands were such that constant conditions for the whole line were not maintained until 8:40 a. m., when the following readings were obtained:

AT THE PUMPING STATION.

Time.	Pressure.	Pitot.
8:40	87 lb.	.45 inches
8:45	87 lb.	.45 inches
8:50	87 lb.	.45 inches
8:55	87 lb.	.45 inches
9:00	87 lb.	.45 inches
9:05	88 lb.	.45 inches
9:10	88 lb.	.45 inches
9:15	88 lb.	.45 inches
9:20	88 lb.	.45 inches
9:28	88 lb.	.45 inches
9:30	88 lb.	.45 inches

AT FIFTH AVE., COLUMBUS.

Time.	Pressure.	Pitot.
8:41.5	66.7 lb.	.50 inches
8:45.5	66.7 lb.	.50 inches
8:47.5	66.1 lb.	.50 inches
8:51.5	66.7 lb.	.50 inches
8:55.5	66.7 lb.	.50 inches
8:59.5	66.7 lb.	.50 inches
9:03.5	66.7 lb.	.50 inches
9:07.5	66.7 lb.	.50 inches
9:11.5	66.7 lb.	.50 inches
9:15.5	66.7 lb.	.50 inches
9:19.5	66.9 lb.	.50 inches
9:21.5	66.9 lb.	.50 inches
9:25.5	67.2 lb.	.50 inches

The temperature of the flowing gas during the above period was 71 degrees F. at first instrument, and 73 degrees F. at Fifth Avenue.

For computing the quantity of gas flowing at the two stations the average corrected readings are as follows:

PUMPING STATION.

Pressure, 87.5 lbs.
Pitot, .45 inches alcohol.

Temperature, 71 degrees F.
Diameter pipe, 10.13 inches.
Cu. ft. per hr. at 60 degrees, 238,120.
Cu. ft. per 24 hrs. at 60 degrees, 5,714,880.

FIFTH AVENUE.

Pressure, 66.77 lbs.
Pitot, .50 inches alcohol.
Temperature, 73 degrees F.
Diameter pipe, 10.13 inches.
Density, .622.
Cu. ft. per hr. at 60 degrees, 223,730.
Cu. ft. per 24 hr. at 60 degrees, 5,369,520.

The difference between the quantities as determined for the two points would be the leakage loss for the pressure condition prevailing or 345,360 cu. ft. per 24 hours.

At Fifth Avenue measuring station the pressure is reduced to whatever pressure is being maintained in the high pressure lines of the city distribution system. At the times the above results were obtained this pressure was about 15 lbs. In the station is located a Pitot instrument, the tips being connected to the 10-inch line below the regulator. This instrument, therefore, should indicate the same quantity of gas as shown in the high pressure line. To verify this some readings were taken on the station instrument at the same time as those were being obtained on the line, and the quantity of gas computed from the tables as used by the company. The readings taken with the results obtained are as follows:

—Time, 5:42 p. m.—

Line Instrument—Pressure, 57 lbs.; Pitot reading, 80 inches alcohol; gas per hour, cu. ft., 265,600.
Station Instrument—Pressure, 16 lbs.; Pitot reading, 1.7 inches water; gas per hour, cu. ft., 316,370.

—Time, 8:54 a. m.—

Line Instrument—Pressure, 66.7 lbs.; Pitot reading, .50 inches alcohol; gas per hour, cu. ft., 223,730.
Station Instrument—Pressure, 14.5 lbs.; Pitot reading, 1.23 inches water; gas per hour, cu. ft., 263,400.

Comparing these results, that is, taking their ratio, we find for the first case the quantity by the station instrument is .8424 of the main line, and for the second case .8328 of the amin line, thus indicating that the station instrument gives results some 16.2 per cent. high.

In estimating the capacity of a transmission line having given the initial and terminal pressures, the following Oliphant formula is generally used:

$$Q = C\,a\,\sqrt{\frac{P^2 - p^2}{l}}$$

Q equals cu. ft. gas discharged per hour.
c equals constant 42.
a equals factor depending upon diameter of pipe.
P equals initial pressure plus 14.4 lbs.
p equals terminal pressure plus 14.4 lbs.
1 equals length of line in miles.

Applying this formula to the 10-inch line on which observations were made, and solving for the constant C, where

Q equals 227,800
a equals 368 for pipe 10.13 inches diameter
P equals 102
p equals 81.1
1 equals 26 miles,

we find that C equals 50.8 instead of 42. In another case where the drop on the same line is extreme as shown for January 7, 1910, at 6 p. m., where the quantity corrected for the station Pitot instrument is

Q equals 490,200 cu. ft. per hr.
P equals 219.4
p equals 52.4
2 equals 368
1 equals 26½ miles, ½ mile for cooler, valves and fittings, we find C equals 32.2.

In applying the same values as above to the Robinson formula

$$Q = C\,\sqrt{\frac{a^5}{l}\,(P+p)\,(P-p)}$$

where the constant C is taken 48.4, we find for the first case the constant equal to 57.53 and for the second case of high velocity the constant equal to 37.45.

Our observations, therefore, indicate that the constants which are generally used with formulae for pipe line flow should change with the velocity or drop in pressure per mile.

The Municipal Lighting Works of Pasadena, Cal.

The municipal electric light plant of Pasadena, Cal., is now about two years old and has not yet attained its full patronage, but is able to show remarkable results and surplus sufficient to retire $8,125 of the bonds issued to raise money to construct the plant. The total bond issue in 1906, 1908 and 1909 was $325,000, and this has been reduced to $306,250 by payments from earnings since the plant began operations. Interest at 4 and 4½ per cent amounts to about $12,500 a year and is of course decreasing as the indebtedness decreases.

The station has a capacity of 1,500 k.w. in three connecting units. The transformer capacity of the distributing system is 1,900 k.w. There are 4,275 poles and the street lighting system consists of 296 arc lights, 966 40-c.p., 17 60-c.p., 25 80-c.p., 16 200-c.p. tungsten lights, 53 32-c.p. carbon lamps, and 130 cluster posts of 13 lights each. There were 2,357 meters in use July 1 and orders were then in hand for setting 1,399 more. The preliminary estimates of successful operation of the plant assumed 4,000 consumers so that the success with approximately half this number is still more remarkable.

Another source of reduction in revenue is the reduction in rates which took effect September 1, which will neutralize the effect of the increase in number of customers, at least in part. The plant runs in competition with the Southern California Edison Co., which formerly charged 12½ cents per kilowatt hour.

The municipal plant began with charging 8 cents per k.w. hr., which was reduced for the last 7 months of the year to 7 cents per k.w. hr. The new reduction is to 5 cents, which is the rate now charged by the competing company. That company is a large one with plants in Los Angeles and other cities and towns, and so is not dependent wholly upon Pasadena for its profits.

The competition of the municipal plant has reduced the cost of electric lights to consumers more than one-half, and gratitude and public spirit should insure the 4,000 customers necessary for success at the 5-cent rate as quickly as they can be connected. This would still leave more than 2,000 possible customers.

Under the very reasonable rates of the past year the plant has saved to its customers from $90,000 to $100,000 from what they would have been obliged to pay under the old rate. In addition it has paid all the expenses of maintenance and operation, the interest on bonds, the $8,125 of bonds above mentioned, and had a surplus of $15,362.14 for application on depreciation account, which is nearly 4½ per cent on the average investment for the year, $350,000. The reduction in rates from 7 to 5 cents per k.w. hr. will reduce the net receipts for the current year some $1,000 or $1,200 a month, and this must be made up by additions to the list of customers if the good financial record of the past year is to be duplicated, although the plant will pay its way, except as regards a surplus to equate the depreciation account.

The manufacturing cost for the past year was 1.24 cents per k.w. hr., the distributing cost was 0.87 cent, and the total cost for manufacturing and distribution was 2.11 cents.

The total earnings for the year were, for street lighting, $33,311.24; city buildings, $1,129.80; commercial light and power, $40,494.28; total, $74,935.32, an increase of nearly $30,000 over the preceding year.

The total manufacturing cost for the year was $22,719.28; the distribution cost $8,416.55; the general expenses $7,493.58; total, $38,629.41; to which must be added the expenditures for interest and payment of bonds, as above, to give the total expenditures.

Of the balance remaining, $13,537.76 was transferred to the construction account. The total expenditures for construction were $109,360.96, most of this sum having been carried over from the preceding year and being the proceeds of the sale of bonds.

It is confidently expected that the results of the reduction in rates will be fully appreciated by the citizens and that they will promptly come to the support of the plant which has done so much for them and insure the 4,000 customers necessary to the fullest success, and supply even more.

ROADS AND PAVEMENTS

Convicts on Roads—Oklahoma Asphalt Pavements—Vitrified Brick Construction—New York Subway Extensions—Flushing Pavements—Asphalt Repairs

Vitrified Brick Street Construction.

The secretary of the National Paving Brick Manufacturers' Association, Mr. W. P. Blair, has prepared an account of the "trip for observation, inspection, investigation and study of vitrified brick street construction," which was taken by members of committees from the American Society of Municipal Improvements and the Organization for Standardizing Paving Specifications, upon invitation of Mr. Blair and his associates, July 18 to 21. A general description of the trip was given in MUNICIPAL ENGINEERING, September number. The present booklet, 265 pages, is illustrated with half as many more pages of photographs taken on the trip. It contains a word of explanation regarding the reason for making the trip; a list of those present during all or part of it; descriptions of the Indianapolis streets and the Speedway, illustrated by photographs; the same of Terre Haute and its examples of all grades of construction, with numerous detailed photographs, of much value because showing correct construction and showing the reason for defects in streets not correctly constructed; the same of Cincinnati showing mainly defective construction; the same of Columbus, showing much better streets than in Cincinnati, and the reasons therefor.

The exhibits of the results of the rattler tests of brick in progress in Professor Orton's laboratory at Columbus are shown by tables of measurements and weights and photographs of the bricks after passing through the tests. This is a most interesting and instructive exhibit and will be given later. These tests are still in progress and the full program has not yet been completed, so that conclusions can not yet be drawn.

Still better streets in Cleveland are de-

scribed and illustrated on a number of pages, and several of the roads in Cuyahoga County outside of Cleveland are shown also. Several pages of comment on Cleveland show the opinions of the writer thereof concerning the reasons for the excellence of these pavements and roads. They were a revelation to most of those making the inspection. This comment is followed by statements made by all of those present at dinner at the close of the inspection trip, and they all practically agree with the said writer in their expressions regarding the excellence of the pavements and the reasons therefor.

This beautiful and instructive souvenir of the trip was sent to each of the participants and will serve to keep warm the recollections of the trip and the good opinions formed of properly constructed brick pavements.

Asphalt Pavement in Oklahoma.

Oklahoma City, Okla., is making preparations for a large amount of paving during the coming year. On September 19 contracts were let for 16.75 miles of asphalt pavement, comprising 302,670 square yards. The total estimated cost is $984,237.33. The total quantity of excavation estimated includes 237,030 yards of earthwork and 6,700 yards of rock cut, with only about 16,900 yards of embankment. The earth excavation is estimated at 35 cents and the rock at 70 cents. Mr. W. C. Burke is city engineer.

Bids Wanted for Subways in New York City.

The Public Service Commission for the first district of New York is asking for bids for various subways, to be received October 20 and 27.

For the first date is set the Tri-Borough Rapid Transit Railroad, one part beginning under Battery Park, near the waterfront, in the Borough of Manhattan, and running under Greenwich street, Church street, and Broadway (with a connecting line running east and west under Canal street) Irving place and Lexington avenue, under the Harlem river to 135th street and Park avenue, in the Borough of The Bronx, where the line divides. The east side branch extends under Park avenue to 138th street, thence under 138th street, the Southern Boulevard, and Whitlock avenue to a point south of Westchester avenue, where the line emerges and becomes an elevated railroad, thence continuing along Whitlock avenue and Westchester avenue to Pelham Bay Park. The west side branch, beginning at 135th street and Park avenue, extends under Mott avenue, Franz Sigel Park and other streets to a point near River avenue and 147th street, where the line emerges and becomes an elevated railroad, thence continuing along River avenue and Jerome avenue to Woodlawn road. The connecting line in the Borough of Manhattan under Canal street begins near Chrystie street and extends westerly under Canal street and Watts street to West street. In the Borough of Brooklyn, the railroad consists of several portions. One portion, which begins in Fourth avenue near Forty-third street, runs under Fourth avenue to Fort Hamilton, and another portion beginning in Fourth avenue near Fortieth street runs under Fortieth street, New Utrecht avenue and Eighty-sixth street to a point between Twenty-third and Twenty-fourth avenues, where it emerges from the gound and becomes an elevated railroad, thence continuing over Eighty-sixth street and Stillwell avenue to Coney Island. The other portion of the railroad in Brooklyn consists of two branches. One branch begins at the Brooklyn terminal of the Williamsburg bridge and runs as a sub-surface railroad under the plaza of Williamsburg bridge and Broadway to a point between Green avenue and Lexington avenue. The other branch begins under Fulton street near Ashland place and runs under Fulton street, Lafayette avenue and Kossuth place to Bushwick avenue.

For the latter date are set two subways. One, the Lexington avenue route, begins under Battery Park and extends thence under Battery Place, Greenwich street, Trinity Place, Church and Vesey streets and Broadway, Irving Place, Gramercy Park and Lexington avenue, the Harlem river and Park avenue to East 135th street. Here the line divides into two branches. The west branch begins at East 135th street and extends under East 135th and 138th streets, Mott avenue, Franz Sigel Park, River avenue near East 157th street. The east branch extends under Park avenue, Canal street West, and East 158th street to a point near Alexander avenue.

Another, the Canal street route, begins in Watts street at West street, and extends northeasterly under Watts street to Canal street, and thence easterly under Canal street to Broadway, thence under Canal street and the existing subways in Lafayette street and Center street to the Bowery.

The Brooklyn and Manhattan loop lines begin at the Brooklyn terminal of the Williamsburg bridge, at or near Driggs avenue, and extend thence under the plaza of the Williamsburg bridge to Broadway at a point near Marcy avenue; thence under Broadway to a point about midway between Greene avenue and Lexington avenue. The second part begins at a point near Bushwick avenue and extends thence westerly under Kossuth place and under the projected subway in Broadway to Lafayette avenue; and thence westerly under Lafayette avenue to Fulton street; and thence under Fulton street to a point at or near Ashland place, where a connection can be made with a subway now under construction.

Cost of Maintaining Asphalt Streets in Brooklyn.

The accompanying tables give in detail the cost of maintaining asphalt streets in Brooklyn. They are self-explanatory.

ANALYSIS OF COST OF MAINTENANCE OF STREETS.

	Wearing surface		Binder	
	per box.	per cu.ft.	per box.	per cu.ft.
Superintendence	0.094	0.011	0.094	0.011
Superintendent's automobiles	0.067	0.008	0.067	0.007
Repairs to plant	0.090	0.010	0.090	0.010
Repairs to tools	0.049	0.006	0.049	0.005
Dumping privilege	0.059	0.007	0.059	0.007
Coal	0.113	0.013	0.113	0.113
Wood	0.058	0.007	0.058	0.006
Miscellaneous supplies	0.031	0.003	0.031	0.003
Depreciation	0.178	0.020	0.178	0.020
Rent	0.062	0.007	0.062	0.007
Interest	0.089	0.010	0.089	0.010
Taxes	0.026	0.003	0.026	0.003
Total general costs	0.916	0.105	0.916	0.102
Material Costs:				
Asphalt	1.030	0.118	0.377	0.042
Residuum oil	0.083	0.009	0.035	0.004
Sand	0.344	0.039	.....	.....
Stone dust	0.078	0.009	.....	.....
Binder stone	.....	.....	0.471	0.052
Total material costs	1.535	0.175	0.883	0.098
Labor and Trucking Costs:				
Plant labor, including foremen	0.809	0.092	0.809	0.090
Street labor, including foremen	2,163	0.247	2.163	0.240
Trucking	0.556	0.064	0.556	0.062
Total labor and trucking costs	3.528	0.403	3.528	0.392
Total Costs:				
General costs	0.916	0.105	0.916	0.102
Material costs	1.535	0.175	0.883	0.098
Labor and trucking	3.528	0.403	3.528	0.392
Grand total of costs	5.979	0.683	5.327	0.592

ANALYSIS OF COST OF RESTORING OPENINGS IN STREETS.

Total general costs as above	0.916	0.105	0.916	0.102
Total material costs as above	1.535	0.175	0.883	0.098
Labor and Trucking Costs:				
Plant labor, including foremen	0.809	0.092	0.809	0.090
Street labor, including foremen	2,051	0.235	2.051	0.228
Trucking	0.710	0.081	0.710	0.079
Total labor and trucking costs	3.570	0.408	3.570	0.397
Total Costs:				
General costs	0.916	0.105	0.916	0.102
Material costs	1.535	0.175	0.883	0.098
Labor and trucking costs	3,570	0.408	3.570	0.397
Grand total costs	6.021	0.688	5.369	0.597

TABLE SHOWING MONTHLY COSTS, PRODUCT, AND BOX COSTS.

January	1,154.02	.....	.....	64	36	..
February	1,365.12	.....	.....	59	39	2
March	6,366.43	1.788	3.56	28	57	15
April	7,142.82	2.589	2.76	22	61	17
May	8,049.23	3,019	2.98	18	64	18
June	1,211.86.65	3,891	3.11	18	64	18
July	6,433.89	1,665	3.86	22	61	17
August	9,803.33	2,294	4.27	22	61	17
September	7,191.71	1,853	3.88	24	60	16
October	7,963.96	2,432	3.28	22	60	18
November	8,959.28	2,472	3.62	21	60	19
December	4,231.29	1,110	3.81	23	59	18
Totals	81,895.18	23,113	3.541	23	60	17

TABLE SHOWING COST OF MAINTENANCE OF ASPHALT PAVEMENT, YEAR 1909.

Year Laid.	Material Used in Repairs. wear. surf. cu. ft.	binder. cu. ft.	Total cost.	Yardage.	Years past guar.	Cost of maint sq. yd
1886	.....	.....	.....	235	18	....
1887	991.46	193.50	$791.71	4,763	17	.0166
1888	5,796.80	763.50	4,411.22	44,141	15	0.10
1889	5,524.40	899.00	4,305.37	43,162	15	0.10
1890	962.48	193.50	771.92	16,647	14	0.046
1891	5,902.54	2,055.50	5,248.30	25,124	13	0.209
1892	2,408.67	561.50	1,977.53	33,313	12	0.059
1893	1,021.47	221.50	828.79	20,359	11	0.041
1894	5,208.10	1,249.50	4,296.84	59,496	10	0.072
1895	13,594.12	2,825.00	10,957.20	164,203	9	0.067
1896	8,899.23	1,868.00	7,184.04	189,349	8	0.038
1897	32,445.00	6,622.75	26,080.62	425,442	7	0.061
1898	1,807.14	500.50	1,530.56	51,826	6	0.295
1899	426.55	90.00	344.61	51,923	5	0.007
1900	2,325.89	576.75	2,271.51	124,603	4	0.018
1901	2,118.91	816.50	1,930.58	74,651	3	0.026
1902	3,381.75	769.50	2,765.26	336,754	2	0.008
1903	17,416.82	6,780.50	15,613.76	877.803	1	0.013
1904	96.25	18.00	76.39	684,135	..	0.000
Totals	110,827.58	26,505.00	91,386.21	3,227,929	..	0.023

COMPARATIVE COSTS OF MAINTENANCE OF ASPHALT PAVEMENTS PER SQUARE YARD OF TOTAL YARDAGE OUT OF GUARANTEE, TOGETHER WITH UNIT PRICES FOR WORK.

	Municipal Asphalt Plant.					Contract System.			
	1909	1908	1907 Jul-Dec.	1907 Jan-Jun	1906	1905	1904	1903	1902
Unit—Surface	0.698	0.844	0.852	0.81½	0.56	0.67	0.85	0.95	0.90
Prices--Binder	0.597	0.737	0.745	0.35½	0.25	0.25	0.30	0.40	0.50
All streets	0.028	0.0384	0.0559		0.0350	0.0345	0.0422	0.0732	0.0579
Railroad streets only	0.089	0.0637	0.1390		0.0630	0.0720	0.0681	0.14.5	0.1780
Non - railroad streets	0.021	0.0353	0.0481		0.0321	0.0314	0.0392	0.0644	0.0418

Summary of costs of maintenance for the year 1909 of all the asphalt pavements in Brooklyn out of guaranty.

All streets	3,227,929	$91,386.21	0.028
R. R. streets.	348,240	30,877.10	0.089
Not R. R. sts.	2,879,689	60,509.11	0.021

The unit prices given are per cubic foot of material measured in trucks, as deliverd on streets. The costs of maintenance are given per square yard, and are the total cost, divided by the total yardage in the respective classes.

Convict Labor on Roads.

Mr. W. S. Blatchley, State Geologist of Indiana, strongly recommends the employment of prison labor on the construction and maintenance of public roads. His plan for doing this is as follows:

Let the general assembly authorize the purchase of an extensive bed of shale in western Indiana and the erection on it of a modern paving brick factory. Equip this factory with convict labor and put several hundred additional convicts to breaking stone for foundation and cutting it for curbing. This brick and stone can then be furnished at the plant at less than one-sixth present prices to these counties devoid of other road material, or may be given them if they are not willing to buy it. The cost of a paving brick plant, completed for work, which has a capacity of 40,000 output per day, is about $55,000. One with double the capacity costs about $70,000. The greater amount of this expense is for buildings and kilns, which could, by convict labor, be constructed of brick made on the spot, so that the cost to the state would be less than half this sum.

After the plant is once in operation, with fuel and raw material both at hand, the only outlay is for labor. Where the daily output is 80,000 brick, and the fuel is mined in connection with the shale, the number of hands necessary is about one hundred. These at $1.50 each per day, would make the cost of the brick about $2.25 per thousand. With convict labor the actual cost of the brick would only be the sum paid out for the maintenance of the prisoners. It costs 40 cents a day to maintain a convict. To this add 50 per cent. for wear and tear on tools, etc., and the cost would not exceed 60 cents a day. A year's output would be sufficient to pave 125 miles of roadway. There are forty-two brick to a square yard of roadway and 503,000 to a mile of roadway twenty feet wide. The cost of this brick by convict labor would thus be $300. The crushed stone could be prepared by convict labor within the prison at not more than 30 cents a cubic yard. Adding this to the cost of the brick makes the cost of the material for one mile of road $665.

Not only could brick and macadam be made for roadways in the prison which I have in mind, but all brick, both ordinary and pressed front, could be made for all public buildings, such as jails,

court houses, school houses, insane asylums and county infirmaries. The shale and fire clay is in every way suitable for such material, and it could be furnished at cost, which would not be over $1.50 per thousand for the finest of pressed front and ordinary brick. The public pay the taxes to erect such buildings, and also the taxes for maintaining the prisoners. Why not, then, have those prisoners prepare the material for public buildings and so lessen the tax burden of the people?

In this connection it might be mentioned that Minneapolis makes use of her short-term prisoners in the city workhouse, to do just such work as Mr. Blatchley advocates. The greater portion of the male prisoners are employed in the manufacture of brick from clay found on deposit within the workhouse grounds. About 160 men are employed in this labor and the output of the plant is 40,000 brick per day which are sold for $6 per thousand. Mr. F. R. McDonald, the superintendent of the Minneapolis institution, states that the general condition of the prisoners, their attitude toward their work and their physical condition is improved by their being allowed to do this work.

Flushing Pavements with Water Under High Pressure.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The above heading is quoted from an article in your May issue, vol. xxxvi, p. 307, entitled "Causes and Prevention of Defects in Asphalt Pavements." by Isaac Van Trump, Chicago, Ill. The article includes "flushing with water under high pressure" as one of the "causes of defects in asphalt pavements which are almost entirely under the control of the municipal engineer," and adds: "It is entirely unfair to the municipality, the tax payer and the contractor for the municipal engineer through ignorance or neglect to permit conditions to exist, either during the construction or after the street has been completed, that will permanently impair the usefulness or appearance of the thoroughfare." This is sound advice from one who has closely watched the evils of the high pressure flushing system of street cleaning; but what heed does the city or Chicago pay to its and some other cities' technical advisers? In the current number of another engineering journal we find a half page photograph of "one of Chicago's forty-one new flushing machines," forcing water, from about one foot above it, under pressure, on the surface of the pavement. Is it any wonder that contractors and surety companies in Chicago and elsewhere are repudiating their guarantees, as shown by an able paper in 1907 by John W. Hittell, Chicago's chief engineer of highways, before the American Society of Municipal Improvements?

The writer and others who have had long experience with construction and maintenance of pavements, have condemned this injurious system of street cleaning, which ruins pavements of all kinds, fills sewers with street dirt, consumes an excessive portion of water supply and is otherwise not economical.

A recent test of cleaning by high pressure flushing system, in New York City, shows as reported:

(a) Cost 72 cents per 1,000 sq. yds. per cleaning, for labor and water.

(b) Two gallons of water consumed per sq. yd. of pavement cleaned.

(c) Cost of water, 9 cents per 1,000 gallons.

At this rate in a city having 200 miles, say 4,000,000 sq. yds. of pavement, cleaned daily (Sundays excepted), say 300 times per year, the cost would be $2,880 per day, or $864,000 per year.

The water consumption figures 8,000,000 gallons per day, at 9 cents per 1,000 gallons, equals $720 per day, or $216,000 per year, or about approximately the cost of water supply of a city of 50,000 population. Knowing that the water used in flushing carries to the sewers at least 10 per cent of its bulk of street dirt and a large portion of the dirt settles in the sewers, we see the great additional cost of sewer cleaning.

Every engineer, or official, and every periodical which is interested in construction and maintenance of street pavements, should persistently and at all possible times and places raise their voices in loud acclamation against this system of pavement ruination.

On this subject I quote the following from the *St. Louis Daily News* of May 20:

Present Method of Flushing the City's Streets Detrimental to Their Proper Maintenance—Volume of Water Employed Is Excessive—Unnecessary Expense to Tax Payer.

From more than one source have lately reached the *Daily News* complaints—which would seem to be justified—with regard to the system of flushing the city's streets.

"No one can have failed to notice the tremendous force with which the water is projected from the flushing machine employed in cleaning our streets, a force sufficient to drive the sand and soil from between the interstices of the granite blocks with which some of the streets are paved and to work serious damage to those artificially constructed asphalt or bituminous surfaces. The result has been that repairs to the streets become necessary much more frequently than is at all necessary or than would be the case if a more natural system of cleaning were employed.

Nor is this all. The volume of water consumed in street cleaning operations at the present time is excessive, and is also a source of unnecessary expense to the long-suffering public. So great, indeed, is the flow of water sewerwards down the gutters when the "flushers" are at work that few can get off the sidewalk without wading. With this stream goes not only all the street refuse but also much of the paving materials.

During the past year the street department has curtailed the use of flushing machines and the improvement in the condition of the pavements is marked.

Interviewed by a *News* reporter the

street commissioner, Mr. Travilla, admitted that these flushing machines now in use, if employed too frequently, damage asphalt or bituminous paving. The damage to brick, granite and wood pavements is also great, causing the joints to be opened, the pavements to be loosened and steadily dislocated, uneven and need excessive repairs.

Constant patrol hand sweeping, with occasional machine sweeping and light sprinkling just before sweeping, to allay dust, has been demonstrated to be the most economical, satisfactory and efficient method, not only for preserving pavements but especially for keeping streets constantly clean at all times of day.

J. W. HOWARD.
Consulting Engineer, Roads, Streets, Pavements, New York City.

It may be added that the city of St. Louis is reported to have rejected all bids for cleaning streets by flushing for the ensuing year.

SEWERS AND GARBAGE

St. Louis Sewer Specifications—Somerville Refuse

Specifications for Sewer Construction in St. Louis.

BY H. R. FARDWELL, SEWER COMMISSIONER.

At the convention of the American Society of Engineering Contractors held in St. Louis, Sept. 26, 27 and 28, Sewer Commissioner Fardwell of that city presented a paper on "Sewers and Sewer Construction in St. Louis," too late to be given in full in this number of MUNICIPAL ENGINEERING. The following discusion of certain difficult points in the specifications is abstracted and other parts of the paper will be given later:

Some of the main points in the specifications that might be discussed by the contractor and engineer are the specifications for concrete and the different classes of excavation, giving special attention to rock excavation.

In all the specifications at the present time under which our work is being carried on, there are two classifications of excavation, viz.: Class "A" and Class "B." Class "A" is solid rock, including detached pieces of rock or boulders one cubic yard or more in contents, and all masses of solid, well-defined ledges of stone or masses of rock. Class "B" includes all other materials encountered. In my opinion, a better classification might be had, provided the engineer and contractor could reach some understanding as to the method of bidding, which neither would vary from.

In the above classification, Class "B" material may be either earth, macadam, shale, fire clay, gumbo, or cinders with various kinds of rubbish dumped in excavations on the street. It is an undoubted fact that shale, fire clay and gumbo will cost more to excavate than good top soil or clay; it is also known that the concrete on the top of streets and macadam cost more to excavate than earth, but under this classification, the contractor is required to make a bid on anything that may be encountered, so that it is necessary that he either take a chance on these materials or make his bid sufficiently high so as to take care of them. In case he does encounter them and has not made his bid to cover the same, he loses money; in case he does make his bid sufficiently high and does not encounter these materials, the city loses money. The city, however, in trying to minimize this difficulty, has, in some of the districts, used core boring machines and given to the contractor a continuous core at certain definite points. These cores were on exhibition in the office of the Sewer Commissioner and were to be seen on application. In districts where core borings were not made, a punch rod, with a spoon, was used, and samples were taken every five feet of depth; this, of course, does not give as good an idea of the condition of the ground as core borings.

Incidentally, as a matter of interest from personal observation, it might be stated that some of our contractors do very little more than walk over the site of the work. In one of our particular contracts we had core borings made to show the nature of the limestone and the kinds of material above the limestone, so that the contractors might know the exact condition of the ground at various places, and out of twelve or fifteen contractors that took out plans for this work, only two looked at these core borings; still, they put in bids.

Core borings, as well as the punching rod method of testing the ground, are expensive. If there were some means whereby it would not be necessary to do core boring, to any great extent at least, or test the ground by means of punching rods, the city would save not only on the excavation but also the money spent for preparing estimates. The necessity for doing this preliminary work would be lessened if the classification was enlarged, thereby giving the contractor the means of

securing pay for the different materials encountered in his work.

Some of the contractors seems to think the old specifications for sewer work are better. Itn hese specifications, the classifications for excavation were Class "A", Class "B" and Quicksand. One of the main reasons for discontinuing the use of these classifications is in the Class "B"—loose rock. The old specifications read as follows: "Class 'B' shall include all stone, boulders and detached pieces of rock lying in separate masses more than three cubic feet and less than one cubic yard in size; also all slate, shale, soapstone, cemented gravel, coarse boulders in gravel, hardpan, or similar substances." This, in our estimation, was entirely too open, as the contractor could make a claim on any kind of material and get more classification than was intended. This particular paragraph could be approved, however, if the words "similar substances" were left out and there was any method of determining the exact number of the classes of material encountered. This latter, of course, is practically impossible to do. The final estimate would not carry the same number of yards of the various classifications that were preliminarily estimated, upon which the contractor had to bid. This gives the contractor an opportunity to bid more than any one classification should cost, provided he thinks it is underestimated, thus introducing the gambling element which should be eliminated at all times from all contracts. Undoubtedly, some method should be established for limiting the price of excavation and rejecting the bids when the contractor exceeds this price. As it is now, the lowest bidder, to whom work is awarded, is not necessarily the one whose prices are lowest when the final estimate is made out. In all probability, the method of reaching this result might be obtained by taking one of the classifications as a base and fix the ratio for the other classifications, and if this ratio is exceeded, all bids to be declared unbalanced are rejected.

Another source of trouble, both to the engineer and the contractor, is the limiting lines to which the contractor will be paid for rock excavation. Some contractors claim that it is impossible to drill holes and shoot rock to any prescribed line; this, of course, is a well-known fact. They claim that instead of making an absolute limiting line to which they will be paid, the specifications should read that they shall shoot as closely as possible to these lines; then comes the difficult interpretation of "as near as possible." Some contractors would, in all probability, drill deeper holes and load them with larger charges than they should. The only way that this can be overcome would be for the engineer to have absolute charge as to the method of doing the work. This, of course, is never given, neither should it be. On account of the fact that it is not best to give the engineer entire charge of the method of doing the work, it was thought best that limiting lines should be given to which excavation would be paid, regardless of where the rock might break to, and in case it broke beyond these lines, the contractor would be required to refill the cavities thus created, with concrete or other material satisfactory to the engineer in charge, at his own expense.

CONCRETE.

About five years ago, reinforced concrete sewer construction was introduced in St. Louis. At the present time, there is a large amount of this work under contract, and the specifications have undergone considerable change since this work was begun.

Following are the specifications governing the materials and the method of mixing and placing concrete, at this time.

The specifications for cement are those of the American Society of Civil Engineers.

Gravel or Broken Stone for Concrete.—All stone for concrete shall be hard limestone or washed gravel. The stone must be quarried from ledges and have a specific gravity of not less than 2.60. Any stone which shows a tendency to break into flat, thin pieces, will be rejected.

Broken stone and washed gravel must be free from dust, earth and other foreign materials. The grading of the stone or gravel shall be such that 100 per cent will pass a ring 1½ inches in diameter; not more than 70 per cent. nor less than 50 per cent. will pass a ring 1⅛ inches in diameter; not more than 40 per cent. nor less than 30 per cent. will pass a ring ⅝ inch in diameter; and not more than 5 per cent. will pass a ring ¼ inch in diameter.

After the broken stone or washed gravel has been graded to meet the above requirements, the voids will be calculated in the following manner: Broken stone or washed gravel shall be shoveled loosely, without compacting, into a box of known capacity, and shall be struck with a straight edge level with the top of the box. The actual volume of the broken stone or gravel shall then be determined.

The following expression represents the percentage of voids in the mass under consideration: Volume of box minus volume of broken stone or washed gravel divided by the volume of the box.

Concrete.—Concrete shall be composed of cement, sand and broken stone or gravel, and divided into Class "A," Class "B" and Class "C."

Mortar for Class "A" concrete shall have the ratio of 1 barrel of cement to 7.6 cubic feet of sand. Mortar for Class "B" concrete shall have the ratio of 1 barrel of cement to 11.4 cubic feet of sand. Mortar for Class "C" concrete shall have the ratio of 1 barrel of cement to 15.2 cubic feet of sand.

Concrete shall be made by mixing with the broken stone or gravel an amount of mortar of the proper class, which shall be 10 per cent. in excess of the voids in the stone or gravel.

Concrete of the class specified shall be used in such forms and dimensions as are shown on the plans or described in these specifications, and in such places as the Sewer Commission may direct.

Whenever an arch is turned or an invert or side wall is built, it shall be immediately covered with boards and kept

wet, in order that the concrete may be protected from the sun.

If a machine is used to mix concrete it shall be of an approved kind and one which measures the exact ingredients of each batch of concrete. Mixing shall continue until the face of every particle of stone or gravel is completely coated with mortar. The mixer shall be tested, and the batch of concrete, of the size that will give the best result will be used. The entire contents of one batch must be dumped at one time.

A continuous mixer in the operation of which the proportions of the ingredients depend upon the shovelers shall not be used.

Concrete may be mixed by hand if so directed by the Sewer Commissioner; provided, however, that suitable precautions are taken to insure accurate measuring and a thorough mixing of the ingredients. The concrete so mixed must be satisfactory in every way to the Sewer Commissioner.

Sufficient water shall be added to each batch of concrete to make it pass freely into the forms and around the reinforcement, but not enough to cause the gravity to separate the component parts.

Retempered concrete and concrete in which the initial set has begun shall not be used.

The surface of concrete in place and already set shall be roughened, cleansed and coated with ½ inch of Class "A" mortar before the fresh concrete is deposited.

Concrete, after being mixed as above specified, shall not be subjected to a fall that will separate the component parts.

Concreting shall proceed continuously for the length of sewer under construction, so that there shall be no line of separation between the batches.

The method of tamping the concrete shall be such as to form a compact, artificial stone.

Water-tight forms of dressed lumber or metal plates shall be constructed, and the prices bid for the concrete shall include the cost of these forms.

Forms shall be set true to the lines designated, and shall be made firm and secure. They shall be satisfactory to the Sewer Commissioner, and remain in place as long as he deems necessary. The finished surface of the interior of the sewer shall be left smooth.

The principal difference between the specifications now in use and those that were originally used on some of the earlier work is in the grading of the rock or gravel. The rock and gravel were screened free from dust and other impurities, and graded in size from 1½ inches to ¼ inch, measured on the greatest dimension; not more than 10 per cent. of the ¼-inch stuff were allowed to be used. The various sizes were so graded that the voids, measured in loose heaps, should be between 40 per cent. and 50 per cent. These voids not being determined exactly, made it impossible to state the exact number of cubic feet of cement to be used per cubic yard of finished work; in fact, the specifications above written do not state what is desired with a positive degree of accuracy, but come more nearly describing what is desired than the old way.

As the results to be arrived at are dense concrete, which gives the strength for which the sewer was designed, it becomes necessary for the engineer to use extra precautions in securing enough cement in the mixture. This anxiety on the part of the engineer often results in friction on the work.

A better method in all probability than either of the specifications is to have specified the number of cubic feet of cement to the cubic yard of finished work for the various classes of concrete work which are to be used, and in this way all misunderstanding on the work will be eliminated and the contractor will know exactly what he is bidding on at the time he bid on the work.

The foregoing are some of the principal difficulties that arise in our work, and I am sure some of the contractors deem them trivial compared to some of the difficulties they encounter.

An engineer protects himself by some such general stipulation as this: "Any work not herein specified which may fairly be implied as included in this agreement, of which the engineer shall be the judge, shall be done by the contractor without extra charge." This, of course, covers a multitude of sins. I find but few contractors in St. Louis keeping such records and cost data as will enable them fully to protect themselves when submitting proposals for work. The so-called incidentals and contingencies that arise in the aggregate amount form quite a percentage of the total cost of work, and while most contractors realize in an indefinite way that these charges are to be taken care of, few of them really know what they should amount to.

Refuse Disposal in Somerville, Mass.

In Somerville, Massachusetts, the collection of ashes, garbage and other refuse materials is under the control of the Board of Health, and a competent superintendent is employed to take charge of the department. Ashes and non-combustible materials are deposited on city dumps and combustible materials are burned in an incinerating plant, except that clean paper, rags, bottles and other merchantable materials are sold at a profit.

The garbage is sold directly to farmers and others. The demand for the garbage exceeds the supply, and the city receives considerable pecuniary return from the same. The sale of garbage and merchantable refuse in 1909 yielded $8,649.76.

Health Laws of Ohio.

The Quarterly Bulletin of the Ohio State Board of Health for July-September, 1910, contains the health laws of the state and a full index thereof.

MUNICIPAL AND TECHNICAL LITERATURE

Books for Engineers.

Road Preservation and Dust Prevention. By William Pierson Judson, Consulting Engineer. Cloth, 144 pp., 16 illustrations, $1.50 net. Engineering News Publishing Co., New York.

In this small book the author has collected descriptions of the experiments in improving roads to fit them for the heavy new traffic of automobiles and the like and has drawn some conclusions as to materials and methods, subject, most of them, to change as our information in this comparatively new development in road building is extended. The methods of laying dust more or less permanently are also discussed.

Many of the processes and materials were first tested years ago, but were too expensive for general application at that time. But the greater wear on roads under the modern traffic has increased the expense of repair of the old roads until it has become cheaper in the long run to lay more expensive pavements in first cost, that the repair bills may be diminished. The result is greater economy, but, undoubtedly, greater cost if the totals of first cost and maintenance under the former and the modern methods of construction are compared. Naturally the cost would be greater, the traffic being heavier as well as more wearing upon the roads, not to speak of the greater demands for comfort and convenience, as affected by surface, drainage, grades, bridges, and dustless wearing surface.

The problem is stated in general terms in the first chapter. This is followed by sections on dust prevention by moisture, including water and chemicals, by oil emulsions, oils and coal tar preparations. Then come descriptions of tar macadam, rock asphalt macadam and bitulithic pavements as progressive steps to the best road surface, the cost increasing with the improvement in quality.

For a general view of the field with illustrated descriptions of the machinery and methods in successful use, the book will be found satisfactory.

Dustless Roads, Tar Macadam. A practical treatise for engineers, surveyors and others. By J. Walker Smith, city engineer of Edinburgh and late borough engineer of Barrow in Furness. Cloth, 225 pp., with tables, $3.50 net. J. B. Lippincott Company, Philadelphia, Pa.

The author is an English engineer who has had much experience in the use of tar in tar macadam pavements and in spraying roads, and he has prepared a thorough book giving the results of English practice and much instruction upon the details of materials, methods and results. This statement of the results of the years of English experience in the reduction of the dust nuisance and the meeting of the necessity for economical improvement of road surfaces to meet the demands of modern motor vehicle traffic should be of very great value to American engineers working upon the same problems with the same materials under conditions similar except as to variations of climate.

The first chapter states the problem and shows the necessity for standardizing methods and materials. The second chapter gives a very full and valuable discussion of all the varieties of tar and the methods of treating them, with the difficulties met. The improbability of a tar famine is quite clearly shown by arguments based on statistics which can be duplicated very nearly in this country. This chapter and the next two reduce the materials of tar macadam pavements to standards.

Methods of laying the various kinds of tar macadam are quite fully described and illustrated by plans of plants, machinery, etc., in five chapters. Then follow discussions of such details as wear, porosity, density, crown, gradient, cleaning, watering, repair, maintenance, etc., showing the extent of the author's experience and the value of his advice. Tractive efforts on various kinds of macadam are compared in one chapter.

The author has collected much information from official reports and from individual officials, which he classifies and analyzes, with much intelligence and resultant value.

The methods and results of tar spraying of existing roads and the limitations of the method are briefly but clearly set out in one chapter.

Every engineer interested in this class of construction should study this book carefully.

The Health of the City. By Hollis Godfrey. Cloth, 372 pp., $1 net. Houghton, Mifflin Company, Boston, Mass.

Much of the material in this volume has appeared from time to time in the *Atlantic Monthly*, and it gives an excellent statement in non-technical English of what is known about the effect of impurity in air, milk supply, the city's food, the preparation of food, city water, ice, sewerage and plumbing, to each of which a chapter is devoted. City noises and their regulation, city housing abroad and at home are also considered. A brief bibliography closes the book.

The author is safe and sane and is as

definite in his treatment of the subject and his statement of conclusions as the limitations of his method permit. It should prove an excellent book for the health or sanitary officer in his efforts to lighten his labors by educating the people he is trying to serve.

The New Building Estimator. A practical guide to estimating the cost of labor and material in building construction from excavation to finish, with various practical examples of work presented in detail and with labor figured chiefly in hours and quantities. A handbook for architects, builders, contractors, appraisers, engineers, superintendents and draftsmen. By William Arthur. Cloth, 477 pp., plates and index, $2.50. David Williams Company, New York.

The second edition of this book was received last year and the appearance of this third edition so promptly is evidence that the book meets a large demand.

This edition contains all the material of the second edition, a few additions to several chapters and about 60 pages of new material in added chapters. Some of the new tables give radiating surface of steam pipes, areas of plastering in various sized rooms, comparisons of hand and machine work, etc. A new chapter goes into detail in estimating cost of reinforced concrete for foundations, walls, columns, floors, slabs, beams, etc., and of complete buildings of various methods of construction. There are also estimates of various patented forms of details. This adds materially to the value of an already very convenient book.

Dust Preventives and Road Binders. By Prevost Hubbard, assistant chemist, Office of Public Roads, U. S. Department of Agriculture; secretary of the committee on road materials, American Society for Testing Materials. Cloth, 416 pp., $3 net. John Wiley & Sons, New York, N. Y.

The development of the treatment of macadam roads to prevent dust and reduce wear has advanced sufficiently to warrant such a book as this, which is a careful effort to classify the methods and materials which have been tested and show their fields of application and suggest the best methods of use. The discussion is rather from the theoretical side, but is given a practical turn by the large experience of the author in the testing of materials and the observation of their action when used in actual construction both for purposes of comparative tests and in the regular line of road improvement.

The necessities of dust prevention, and the desirability of road preservation, particularly under the new demands of automobile traffic, are shown in the first chapter and then the author attacks his materials, first classifying them as temporary, semi-permanent and permanent binders and then according to their constitution and chemical characteristics. Subsequent chapters take up the inorganic dust preventives and binders such as water, sea water, bitumen, calcium chloride, sodium silicate, rock dust, etc., and hydraulic cements; the organic non-bituminous substances used for the same purposes, such as vegetable and animal oils and fats, waste sulphite liquor, molasses residues, rosin and resinates; and the hydro-carbons, which are fully classified and discussed as to details of chemical structure. The bituminous materials are also classified closely after Richardson's system, using only those which have shown promise as materials for treating roads as distinguished from pavements, viz.: petroleum and its products, semi-solid and solid native bitumens. Methods of application of the materials are given in full detail, providing a historical review of the development of the use of each. The chapters treat of petroleum and asphalt, tar and tar products in the treatment of roads already built; and to the application of tar and the construction of bituminous macadams according to various processes.

The chapters on examination of bituminous road materials and interpretations of results are full and comprehensive. One of them gives a full account of the methods which have been developed in the Government laboratory, and one of those proposed or adopted by the American Societies for Testing Materials and of Civil Engineers. These are supplemented by a valuable chapter on the selection of materials for particular uses and conditions, which contains specifications for road tar and oil.

At this stage of the progress of the art of road building this book forms a foundation for a thorough knowledge of the subject and, when supplemented by books devoted to the practical construction, will show the reasons for certain methods of procedure and for the failures of others and the probabilities of success or failure of almost any proposed method.

The Hindrances to Good Citizenship. By James Bryce. Yale lectures on the responsibilities of citizenship. Cloth, 134 pp., $1.25. Yale University Press, New York City.

The author of this book is qualified by long years of observation and experience in positions with the greatest opportunities for securing broad views of political subjects, to ascertain and state the governing conditions of our modern civic life. He has certainly succeeded in putting clearly before the reader the defects in the conduct of individuals which have resulted in our municipal troubles, and it only remains for the individual to make application of the principles developed to insure that he has done his full share toward the betterment of conditions. If every citizen should read the book and act according to its precepts, our civic troubles would shortly disappear in very large part.

The author names three hindrances to good citizenship, indolence, self-interest and party spirit, the first of which he terms the most common, the second the

most noxious, and the third the most excusable but most likely to affect the politicians, to which class most voters have belonged until very recent years, since the first has got in its full influence. These cover the ground, and there remains only the removal of the ignorance of the principles of self-government and of the methods of applying these principles to bring into existence the perfect city. With indolence changed to interest and study begun, with self-interest convinced that it best serves itself by conserving the interests of all, the upward movement will begin. Party spirit, modified by individual knowledge of right principles, more widely spread through the process of education, will more nearly insure progress in the right direction, for each party being actuated by high motives, the party differences will be due to the variations in opinions upon the best method of procedure, and intelligent party spirit will lead to more thorough consideration of problems. It should also lead to changes in line up as the problems to be solved change, for intelligent party spirit will not maintain a party after its problems have been solved, but will form new parties to attack new problems.

The author discusses the live problems of this country impersonally and under cover of other countries and yet so clearly that he cannot be misunderstood, at the same time that he follows strictly the letter of precedent and courtesy and disarms all criticism regarding the expression of opinion upon local questions by the representative from another nation.

ORGANIZATIONS AND INDIVIDUALS

American Society of Municipal Improvements — Engineering Contractors—Engineer Draftsmen—Central States Water Convention—Philadelphia City Club—Technical Organizations—Technical Schools—Civil Service—Personal Notes

The American Society of Municipal Improvements.

The seventeenth annual convention of the American Society of Municipal Improvements will be held in Erie, Pa., October 11, 12, 13 and 14 at the Chamber of Commerce rooms in the Reed Hotel.

The preliminary program has been issued and indicates sessions of more than usual value. It includes the following papers and committee reports:

At the afternoon session of October 11—Report of the committee on Sewerage and sanitation, by George C. Whipple, consulting sanitary engineer, New York, chairman; "Present Use of the Septic Tank," by H. N. Ogden, professor of sanitary engineering, Cornell University; "Municipal Sanitation in Cuba," by R. Winthrop Pratt, engineer, Ohio State Board of Health; "Construction of Exposed Sewers at Leavenworth, Kan.," by Joseph O'Neil, city engineer of Leavenworth; report of committee on disposition of garbage and street cleaning, Louis L. Tribus, consulting engineer, New York, chairman.

At the evening session of October 11—"European Sewage Disposal Works," illustrated by lantern, by Rudolph Hering, consulting engineer, New York; report of the committee on water works and water supply, by J. Walter Ackerman, superintendent of water works, Auburn, N. Y., chairman; "Improvements in Check Valves on Auxiliary Supplies," by J. Walter Ackerman; report of committee on park development and maintenance, by A. M. Reynolds, chief engineer Essex County, N. J., Park Commission, chairman; paper by F. L. Olmstead, landscape architect, Brookline, Mass.; paper by H. S. Richards, assistant superintendent of South Park Commission, Chicago, Ill.

At the morning session of October 12—Report of committee on street paving, by Wm. A. Howell, engineer, street department, Newark, N. J., chairman; "Modern Stone Block Pavements," by Wm. A. Howell; "Bituminous Pavements, Patented and Otherwise," by E. A. Kingsley, superintendent of public works, Little Rock, Ark.; report of committee on Standard specifications, C. H. Rust, city engineer, Toronto, Canada, chairman; report of sub-committee on asphalt pavements, by A. W. Dow, consulting chemist, New York; report of sub-committee on brick paving, by E. H. Christ, Grand Rapids, Mich.; report of sub-committee on bituminous paving nomenclature, by W. W. Crosby, state highway engineer of Maryland, Baltimore, Md.; report of committee on street lighting, by E. A. Fisher, city engineer, Rochester, N. Y., chairman; report of committee on fire protection, by

Alcide Chausse, city architect and superintendent of buildings, Montreal, Canada, chairman.

During the afternoon of October 12 a boat ride on Presque Isle bay to points of interest and a fish fry at the Country Club.

At the evening session of October 12—Discussion of questions and topics. Among those submitted are the following: Catch basins; when should they be used and when simple inlets only? What can the society do to increase its value to its members, especially those who cannot attend the conventions? Standard specifications for curbs, gutters and street crossings.

At the morning session of October 13—Report of committee on municipal data and statistics, by Ernest McCullough, editor *Railway Age Gazette*, Evanston, Ill., chairman; "The Census Bureau's Municipal Statistics," by A. Prescott Folwell, New York; report of committee on taxation and assessment, by A. M. Heston, city comptroller, Atlantic City, N. J., chairman; "Taxation," by A. M. Heston; report of committee on municipal franchises, by Charles Carroll Brown, editor MUNICIPAL ENGINEERING, Indianapolis, Ind., chairman; report of committee on city government and legislation, by S. A. Freshney, secretary and general manager board of public works, Grand Rapids, Mich., chairman; report of committee on review, by C. D. Pollock, acting chief engineer, bureau of highways, Manhattan, New York, chairman.

Erie is laid out on the rectangular plan. East and west streets are numbered, beginning at the lake front. The main street is State street, which passes through the center of Central Park, which lies between Fifth and Seventh streets. On this park face most of the principal buildings, including the city hall, the court house, the post office and two of the principal hotels, the Reed House—headquarters of the society—and Park View Hotel. The Union Depot is at the corner of Fifteenth street and Peach street, which is one block west of State.

Erie was settled in 1795 and has a present population of about 68,000.

There are 110 miles of streets, of which 51.14 are paved, over one-half of the paving being asphalt, about one-third brick, with small amounts of stone block and creosoted wood block.

There are about 90 miles of sewers, largely on the combined system.

In connection with the water supply, which is taken from Lake Erie, the city has recently completed an intake extending across the bay and peninsula, and is now completing the construction of settling basins.

The streets are lighted with 692 arc lamps by a private corporation, which charges 18 cents per light per night; also by 548 Welsbach lamps at 5½ cents per light per night.

There will be the usual exhibits and the arrangements for entertainment of delegates and ladies, and for inspections of matters of interest to engineers and municipal officials, in addition to those named above, are ample. The sessions will continue until noon of Friday, in order to give time for the discussions which are always of great interest.

Ben E. Briggs, city engineer, is a vice-president of the society and is in charge of the local arrangements, and will give any information about details that may be desired.

One of the most important subjects of discussion will be that of standard specifications. The general committee has a report on the program, and several of the special committees on specifications for pavements also have report to make.

The Convention of the Central States Water Works Association.

The fourteenth annual convention of the Central States Water Works Association was held in the Claypool Hotel, Indianapolis, Ind., on September 20, 21 and 22. The following papers were presented and discussed at these meetings:

"Notes of Experience of Some Tests of Pipe," by Mr. W. R. Conard, consulting engineer, Burlington, N. J. A brief abstract of this paper is given elsewhere in this issue.

"The Acid Water of Western Pennsylvania," by E. C. Trax, McKeesport, Pa. Mr. Trax called attention to the extreme acidity of the Allegheny, the Monongahela and the Youghiogheny rivers. This condition is due to the oxidation of iron pyrites common to the region and to the wastes from coal washers and other mining utilities. The acid is so strong at times as to kill fish in the streams named; and in McKeesport previous to the installation of a water softening plant the waste of water through services damaged by acid was about 50 per cent. Conditions are particularly bad at the time of low water. The two possible remedies proposed are the enforcing of purification laws or the reforestation of lands forming the watersheds, so as to guard against the extreme low water.

"The Obligation of Water Works Superintendents with Respect to the Sanitary Quality of Public Water Supplies," by Paul Hansen, state sanitary engineer of Kentucky, is self-descriptive as to subject matter. Mr. Hansen dwelt particularly on the need of adequate purification provisions and competent handling of such. He stated that the prime duty of a superintendent is to give a safe supply; an economical supply should be a secondary consideration.

"Repairing a Sixteen-inch Main," by Mr. C. W. Wiles, Delaware, Ohio, told of the trouble experienced in repairing a main with a 36-inch 900-lb. sleeve, when, owing to leaky valves, the pressure could not be shut off.

"Clean Water as a Municipal Asset," by

George C. Whipple, consulting engineer, New York City, was an interesting discussion of the water purification question. He dwelt on the fact that people demand a clean water with a good taste, as well as one that is chemically pure and safe. Bacteriological as well as chemical tests are to be desired. Mr. Whipple states that the calcium hypochlorite method of purification is not entirely adequate. It destroys the B. coli and B. typhi germs, but does not completely disinfect, and will not destroy spore-forming bacteria. The quality used is not enough for oxidation, it adds to the odor and does not improve the taste. It should be used as an adjunct to filtration, as it sometimes enables a higher degree of filtration. It should never be regarded as a purification agent complete in itself, and there is danger through faulty application. In the last portion of his paper Mr. Whipple calls attention to the various factors to be met with in a filtration system, and emphasizes the need of different methods to fit the case at hand. Over-emphasis is often given to stream purification by means of sewage treatment, when the same or better results may be obtained and often at a less cost by purifying the water used. Mr. Whipple recommends the establishing of water softening plants where the hardness exceeds 250 parts per million, and sometimes a little less degree of hardness makes the plant a good business venture. In closing he calls attention to the increasing recognition of the need of abundant clear water and mentions Louisville and Cincinnati as first in the field of mechanical filtration, and Columbus as first with a practicable water softener.

"The Steam Turbine Centrifugal Pump," by C. W. Hurd, of Indianapolis, gives a comparison of the turbine-driven centrifugal pump with the vertical triple expansion type. Mr. Hurd bases his comparison on a 10,000,000 gallon supply pumped against a 200-foot head, with coal fired at $2.50 per ton. The vertical triple expansion type, including boiler equipment, costs $180,000. Computing interest, depreciation, etc., at 9 per cent., the yearly fixed charge is $16,200, or $4.33 per million gallons. By comparison a turbine-driven centrifugal pump of same capacity costs, complete, $90,000. Using the same basis of computation the annual fixed charge is $2.16 per million gallons. Assuming labor, maintenance, etc., to cost the same for either type, the centrifugal type costs $8,100 per year less than the high duty. But the high duty may be operated for about $7,300 per year less than the cheaper type of unit. This makes the saving on the centrifugal type about $800 per year or 21 cents per million gallons cheaper than the high duty equipment. Mr. Hurd recommends the high duty equipment for large plants requiring steady operation, but for the smaller plants under intermittent use the turbine-driven centrifugal is advocated.

"The Business End of a Water Company," by C. E. Inman, of Warren, Ohio, advocated courtesy as a business asset of a water company.

"Floods, Conservation and Their Relation to Water Supply," by Morris Knowles, C. E., is a broad and comprehensive discussion of this much-talked-of subject.

Michigan was added to the list of states represented, so that now the association is made up from Illinois, Indiana, Kentucky, Ohio, West Virginia, Pennsylvania, Missouri, Wisconsin and Michigan. The following officers were elected without opposition: President, A. L. Holmes, Grand Rapids, Mich.; vice president, W. J. Scroggins, Wheeling, W. Va.; secretary, W. A. Veach, Newark, O.; treasurer, A. W. Inman, Massillon, Ohio. Cleveland, Ohio, was chosen as the place of meeting in September, 1911.

American Society of Engineering Contractors.

The first annual convention of the American Society of Engineering Contractors is in session in St. Louis as this number of MUNICIPAL ENGINEERING goes to press. The program includes address of welcome and responses, a paper by Edward Wegmann and J. B. Goldsborough on "The Construction of the New Croton Dam," one by H. R. Fardwell, sewer commissioner, on "Sewers and Sewer Construction in St. Louis," and one by Geo. C. Warren on "Work Preliminary to Road Construction and Street Pavement Maintenance." The last two are given in whole or in part elsewhere in this number. A banquet was held on Tuesday evening, and the committees on uniform specifications, contracts, cost-keeping and analysis made progress reports.

Much time was spent in trips to see the new sewers, which are the largest in the world, the water works and other objects of engineering interest.

The American Society of Engineer Draftsmen.

On June 18 the first steps were taken to form a permanent organization to be known as the American Society of Engineer Draftsmen, embracing every branch of the profession, including mechanical, electrical, civil, architectural, marine, sanitary, automobile and aeronautical draftsmen. The first meeting of the society was held on July 27. The formation of this organization, which was conceived by E. Farrington Chandler, a well-known designer and inventor, marks the first effort to form a national society among draftsmen.

The officers chosen are E. Farrington Chandler, president; William B. Harsel, vice-president, and Henry L. Soan, secretary and treasurer, with headquarters at 116 Nassau street, New York.

The City Club of Philadelphia.

The City Club Bulletin for September 22 gives the program for the following season, two programs for each month. The first three programs are devoted to health matters, pure milk supply, a clean city, and the health activities of various city departments; three to safety, protection of citizens in the street, in other places, and protection of property; one to provisions for convenience; three to education, in schools, for efficiency in daily occupations to cultivate civic intelligence outside of schools; three to prosperity, in affording citizens opportunities to earn a living, in providing transportation by land, and by water; one to the efforts to promote philanthropy, and one to the city plan. The plan of each meeting states the functions that must be performed, the public and private agencies which must perform them, including the public service corporations when any are involved, and their performances and duties.

The club publishes a weekly bulletin which gives quite fully reports of the results of its activities as well as its needs and desires for the future.

Technical Organizations.

The annual convention of the American Street and Interurban Railway Association will be held at Atlantic City, N. J., October 10, 11, 12, 13 and 14. H. C. Donecker, sec'y., 29 West Thirty-ninth street, New York City.

The annual meeting of the American Gas Institute will be held at New York City, October 19, 20 and 21. A. B. Beadle, sec'y., 29 West Thirty-ninth street, New York City.

The annual convention of the Illuminating Engineering Society will be held at Baltimore, Md., October 24. P. S. Millar, sec'y., 29 West Thirty-ninth street, New York City.

The National Land and Irrigation Exposition will be held in Pittsburg, Pa., in October. This offers the clay interests an opportunity to promote the increased use of drain tile.

The International Prison Congress was held in Indianapolis, September 26 to 30.

The thirty-eighth annual meeting of the American Public Health Association was held at Milwaukee, Wis., September 5, 6, 7, 8 and 9. Among the papers presented were the following: "Organization for the Protection of Health," by Dr. Walter Wyman, surgeon-general of the United States Public Health and Marine Hospital Service; "Research Work," H. W. Clark, Boston; "Executive Methods in Preventive Medicine," Dr. H. B. Hemenway, Evanston, Ill.; "The Relations Between State and Municipal Boards of Health," Dr. C. A. Harper, Madison, Wis.; "The Correlation of Physicians, Engineers and Other Experts, in Public Health Work," Prof. Wm. T. Sedwick, Massachusetts Institute of Technology; "Social Economics and Public Health," Hon. Emil Seidel, mayor of Milwaukee; "The Universities in Relation to Public Health Work," Dr. W. H. Hill, Minneapolis; "Water and Sewage Treatment," George A. Johnson, associate member Am. Soc. C. E., of Hering & Fuller, New York City; "Electrolytic Production of Sodium Hypochlorite," Charles P. Hoover, chemist water purification, Columbus, O.; "The Preservation of Sewage by Chloroform and Cold Storage," Dr. Arthur Lederer and Harry B. Hommon, of Sanitary District of Chicago; "Sanitation of Labor Camps," by Dr. Huber Pease, of New York City; "Garbage Collection and Disposal," by Dr. P. M. Hall, of Minneapolis; "Modern Practice in Garbage Disposal," Rudolph Hering, of New York City; "A Portable Hypochlorite Water Treatment Plant for Emergency Use," by H. A. Whittaker and J. A. Childs; "The Self-Purification of Streams as Affected by Changes of Season," Gustav F. Ruediger; "The Relation of the University to Public Health Work," by Dr. H. W. Hill; "The Relation of Dissolved Oxygen in Water to the Quality of the Water," Dr. Arthur Lederer. Officers were elected as follows: President, Dr. R. H. Simpson, Winnipeg, Can.; vice-presidents, Dr. Fernando Lopez, City of Mexico; Mr. John F. Anderson, Washington, D. C., and Dr. G. A. Bading, Milwaukee, Wis.; secretary, Dr. William C. Woodward, Washington, D. C. The officers of the three existing sections are as follows: (1) Laboratory—Chairman, Dr. John A. Amyot, Toronto, Can.; secretary, B. B. Rickards, Columbus, O. (2) Vital Statistics—Chairman, Dr. W. R. Batt, Harrisburg, Pa.; secretary, Dr. F. L. Watson. (3) Municipal Health Officers—Chairman, Dr. A. J. Douglass, Winnipeg, Can.; secretary, Dr. E. C. Levy, Richmond, Va. The next convention will be held at Havana, Cuba.

The Building Trades Employers' Association has announced a competition for designs for single or detached buildings. Full terms of the competition can be obtained by addressing the association at 34 West Thirty-third street, New York City. Designs must be submitted on or before December 1. Prizes in the first class are $100, $50 and $30, and in the second class are $150, $75 and $50 for first, second and third prizes, respectively.

At the meeting of the Municipal Engineers of the City of New York, held September 28, Samuel D. Dodge and William B. Hoke presented a paper on "Studies and Explorations for the Hudson River Crossing of the Catskill Aqueduct."

Technical Schools.

The University Bulletin for July, of the University of Michigan, Ann Arbor, Mich., is a book of 384 pages, containing the announcement of the Department of Engineering for 1910-11, with the courses of instruction, the register of students and the register of alumni.

The Ohio State University Bulletin for August 4 is commemorative and gives a history of the Department of Civil Engineering, biographies of officers, and a register of alumni.

"The Transit," an annual publication of the College of Applied Science of the Iowa State University, contains a detailed description of the Holland, Mich., electric light and power plant. The plant is municipally owned and operated through the board of public works.

Civil Service Examinations.

The United States Civil Service Commission will hold examinations at the usual places as follows:

For clerk-draftsman in surveyor-general's office at $4 a day, or $1,200 a year.

Personal Notes.

Mayor McGaughey, of Veedersburg, Ind., has tendered his resignation, to take effect October 1.

Kitchell M. Boorman, A. B., civil engineer, has opened an office as consulting engineer at 11 Cliff street, New York City.

M. J. Spillane has been appointed a member of the board of sewer commissioners, to succeed Dr. B. F. Chase, resigned.

Dr. B. F. Chase has resigned as a member of the board of sewer commissioners at East Syracuse, N. Y., of which he was president.

William Henry Lakie, district manager of the Barber Asphalt Paving Company, in New York State and Canada, died at Buffalo, N. Y., September 3, aged 39 years.

Mr. D. J. Hauer, of New York City, has recently been appointed eastern editor for the *Contractor*. He is now handling this work in connection with his concrete specialty business.

T. H. Gwynne, for many years manager of the Pittsburg Vitrified Brick Company's plant at Pittsburg, Kan., died recently at Khedive, Pa., where he had been for nearly a year.

J. C. Stevens, Assoc. M. Am. Soc. C. E., who resigned in July as district engineer, United States Geological Survey, at Portland, Ore., in charge of water resources work in the Pacific Northwest, has recently established an office for the practice of hydraulic engineering at 509 Beck building, Portland.

Richard P. Bannon, of Louisville, Ky., a director of the P. Bannon Sewer Pipe Company, and connected with the clay-working business for many years, died recently at his home in that city.

Morris Knowles, M. Am. Soc. C. E., until recently chief engineer of the Pittsburg Bureau of Filtration, has opened offices in the Oliver building, Pittsburg, for the practice of general civil engineering.

The Edmund T. Perkins Company have opened offices as engineers in the First National Bank Building, Chicago, Ill., and will devote their time to projects for the development of natural resources, irrigation in particular.

Jerome Cochran, Jun. Am. Soc. C. E., until recently a consulting engineer at Houston, Tex., has become designing engineer of the Corrugated Bar Company, of St. Louis, Mo., with offices in the National Bank of Commerce, at St. Louis.

Ira G. Hedrick, M. Am. Soc. C. E., and Victor H. Cochrane, Assoc. M. Am. Soc. C. E., have formed a partnership for the practice of consulting engineering under the firm name of Hedrick & Cochrane, with offices at 1118 McGee street, Kansas City, Mo.

Rupert K. Stockwell, Jun. Am. Soc. M. E., has resigned as construction engineer with the United Smelting, Refining & Mining Company of Salt Lake City, Utah, and has become assistant general superintendent for the Alpha Portland Cement Company at Easton, Pa.

Elwood Mead, M. Am. Soc. C. E., M. Inst. C. E., chairman of the water supply commission of the State of Victoria, Australia, is visiting in this country. Mr. Mead is accompanied by Hon. Hugh McKenzie, Victoria Minister for Lands, and the two constitute a land settlement commission, appointed by the State of Victoria to visit England and the United States for the purpose of securing settlers on land owned by the State. An effort will be made to induce settlers experienced in irrigation to go to Australia. The State is said to be putting water on relatively small holdings of land, and also building houses for the farmers. Mr. Mead will be remembered as having been state engineer of Wyoming, chief of irrigation and drainage investigation, United States Office of Experiment Stations, Department of Agriculture, and as a lecturer on irrigation institutions at the University of California for a number of years.

MACHINERY AND TRADE

A Test of Bitulithic Pavement.

Bitulithic pavement was given a unique test in York, Pa., recently, in the presence of the mayor of the city and several citizens interested in paving work. The test consisted of allowing a large traction engine of the A. B. Farquhar Company, of York, to pass over the pavement. The engine was a 15-h.p., weighing ten tons, and its wheels carried the customary cleats on the rear and the sharp center ridge on the rim of the front wheels. These ridges and cleats did not injure the surface of the pavement in the slightest degree. The only marks left were the dust and dirt marks that would be made by any broad wheel passing over a newly paved street.

In addition to this, workmen in the employ of the Standard Bitulithic Paving Company gave a demonstration of the rapidity with which the paving can be repaired, by cutting out a number of sections and replacing them.

A Practical Application of Wireless Telegraph Principles.

The careless manner in which pipes are laid and the fact that few of the older water systems carefully located or platted their pipes, has resulted in a condition of affairs where at times even water or gas mains are practically lost, and to one who has endeavored to find an old service pipe, the trouble is only too well known.

An instrument has recently been put on the market whereby these lost pipes can be easily located. The "wireless" principle upon which the instrument is constructed makes it very easily handled. It may be used to locate a pipe which may be buried beneath ten or fifteen feet of earth, snow, ice, concrete, boards, etc.

The apparatus consists of an instrument for producing an electric current on the pipe which is to be located, and a special head telephone receiver and detector coil, constructed to pick up the electric wave produced by the instrument, so that it can be distinctly heard in the receiver.

After connecting the instrument properly either inside or outside of the buildings, the operator can hear the tone in the receiver distinctly with the detector coil held in the hand. In this manner the exact location of the underground pipe can be followed as many feet, yards or blocks as is necessary.

The vibrating apparatus is mounted compactly in a box, with the six batteries necessary for operation, all self-contained within the case. This part is left connected as desired and does not need to be moved while locating pipe within the circuit.

The detection consists of a detector coil connected by a short length of wire to a receiver, carefully wound and adjusted to the vibrations of the sender. The detector coil is specially made for pipe location work, and is so constructed that it will pick up the tone as soon as brought within the influence of the current, the windings of the detector coil are such as to neutralize the current and kill the tone, thus giving a point of silence when the coil is directly over the pipe to be located. When this point is found, by passing the coil back and forth a few inches the exact location of the pipe can easily be determined.

The Modern Iron Works, of Quincy, Ill., manufacture the apparatus and will furnish full descriptive literature on application.

Durability of Bitulithic Pavement.

In the report of George A. Carpenter, city engineer of Pawtucket, R. I., attention is called to the excellent condition of the bitulithic streets in that city. There are 61,512 square yards of this pavement, laid in 1901, 1904, 1906 and 1908, and it is all in a fine state of preservation. There have been no repairs made on these streets, nor is there any apparent need of such at the present time, even on that pavement which has been in since 1901.

The Success Concrete Pipe Molds.

The three factors, experience, equipment and a determination to make a thoroughly practicable apparatus have resulted in the production of the "Success" concrete sewer pipe and drain tile mold. The "Success" consists of an outer shell of 12 gage steel, made in three sections (to facilitate removal without scraping the tile) and bound together at the bottom with channel steel. The top of the outer shell is bound with a T-steel band to which the cast bell for making sewer pipe is attached by means of cap screws. By this arrangement an ordinary drain tile, without the bell, may be made by simply removing the cap screws. This feature makes a combination mold of the device. The locking devices are simple in extreme; they are so constructed that there is no danger of injuring the tile in unlocking the shell, and are attached to the shell so that there are no parts to become lost or broken.

The core is made of a single piece of

No. 14 gage sheet steel and forms a cylinder with overlapping edges. The core is bound by rigid bands at top and bottom and is regulated by expansion levers which are self-locking so as to eliminate the danger from the core becoming loosened before the tile is finished. In making the bel end of sewer pipe, the casting which is termed the bell core and which forms the socket of the tile, is held in position by means of a set of small levers with hooks which lock underneath the top band of the core and which are easily released after the mold is filled, and which is the first part removed after the tile is made. The device for centering the core is so arranged that after tamping the first filling it is removed entirely out of the way.

The intention has been to construct a mold that would meet the requirements of the practical tile maker and one that could be relied upon to do all that is required of a first-class mold; one that after having made the tile, could be removed from it without disastrous results, and constructed in such a manner and of such material as would best withstand the hardships to which a mold is subject; one that requires no cast-iron pallets, using only board pallets, a good wood or cement floor on which to leave the finished tile; with a perfect arrangement for centering the core, and a core with sufficient expansion and contraction to insure its removal with most exacting results, and which requires no springs, lock nuts or locking device of any nature to hold it in place while the mold is being filled, with the bell made at the top where it can be tamped as thoroughly as the body of the tile.

For catalogues and prices of the "Success" molds and for costs of constructing tile with them write to Grob Brothers, Kendallville, Ind.

Good Roads.

The above title is applied to a handsome book issued by the Port Huron Engine and Thresher Co., of Port Huron, Mich. The book is more than a catalogue of Port Huron road making machinery, for it goes into the history, methods of building, and maintenance of good roads.

Part I, devoted to the history of road making, deals in general with the good roads question from 312 B. C. to 1910 A. D., with especial reference to the construction of macadam roads in Michigan.

Part II takes up the construction of roads from the quarrying of rock to the final rolling. Photographs of actual work are used throughout this part and in other parts as they are needed.

The question of cost is taken up in Part III, and particular care is shown in the comparison of horse and mule power with the more efficient steam power.

Parts IV and V are devoted to the Port Huron machinery in particular, dealing with the construction, operation and "past performances" of their road machines.

The book is especially well gotten up and illustrated in great detail. The tables of cost should be particularly valuable to one interested in good roads, their construction or renewal.

Buff Engineering Instruments.

The 1911 book of the Buff & Buff Mfg. Co., of Boston, is exceptionally well planned and executed. It comprises about 120 pages, printed on the best grade of heavy paper and illustrated throughout with halftones.

The first part of the book is taken up with a description of the points of particular value in the Buff instruments. The reasons and arguments for adopting the forms of construction used are given and a complete illustration is given of each point discussed, with the methods employed in attaining their manufacture.

Following this department is one devoted to photographs of the instrument shops at Jamaica Plains Station, Boston. This section is of interest to one unacquainted with the process of manufacture of surveying or mathematical instruments.

The balance of the book is devoted to the description, specifications and photographs of transits, levels, planimeters, current meters and many other instruments manufactured by the company. The book is of educational value as well as being of interest to one intending the purchase of some of the instruments described.

A Cast-Iron Pipe Handbook.

"McWane's Handbook for Cast-Iron Pipe Users" is the title of a leather-bound pocket-size book, issued by the McWane Pipe Works of Lynchburg, Va. It is issued for the purpose of classifying, describing, and tabulating the line of cast-iron pipe and special castings made by the above mentioned company. No attempt has been made to give general information along the line of water and gas works construction further than to furnish a number of tables useful in hydraulic computations. These tables as well as the standard specifications for cast-iron water pipe, published in the fore part of the book, will be found of value. In connection with these specifications, tables of sizes, weights and dimensions of pipe are given for both the American Water Works Association and the New England Water Works Association standards.

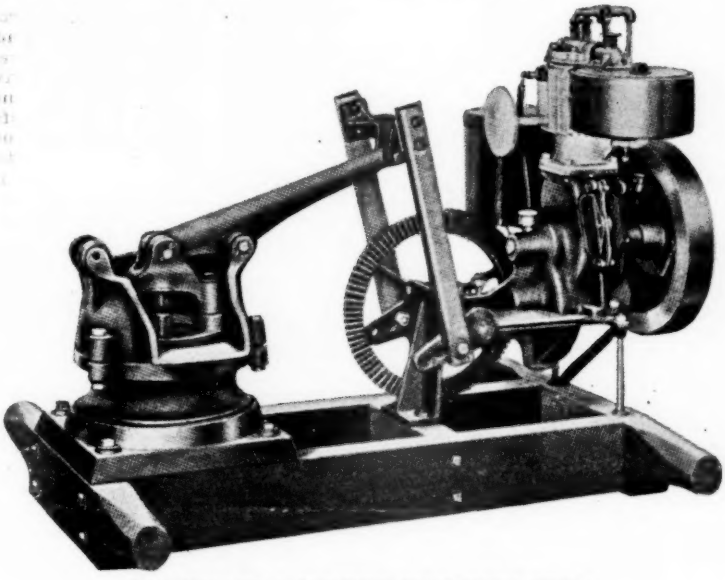
One table of "cost laying as determined by actual practice under varying conditions" is given. In this table items are made of the various factors such as pipe per foot, yarn per foot, lead per foot, trenching and refilling 4-foot cover, etc.

This is all of doubtful value as no reference is made to the class of excavation considered, the freight and hauling of materials and other items that would have a decided effect on the statement of unit cost offered to be used as a basis of comparison.

With this possible exception the handbook should be of value to one interested in cast-iron pipe work.

A New Diaphragm Power Pump.

The Fuller & Johnson Manufacturing Co., of Madison, Wis., have had a farm pumping engine on the market for a number of years. They are now manufacturing a diaphragm power pump operated by their well-known type of engine. The outfit is mounted on a substantial wooden frame and the pump is connected to the engine by a special type fulcrum lever so as to offer a maximum of power efficiency. The entire apparatus is light and may be easily moved about as required.



THE FULLER & JOHNSON DIAPHRAGM PUMP.

The engine is a one-cylinder gasoline type operating the pump at from 31 to 40 strokes per minute. It is capable of exerting a lift of 1,000 pounds on the lever and will easily handle a 4-in. suction diaphragm on a 20-in. lift. A feature of note in this engine is the arrangement of the batteries in a sheet steel battery case rigidly attached to the side of the crank case, so as to be well protected.

The pump is of standard design, with a rubber diaphragm which may easily be removed in case of wear. The suction valve and base check valve are also rubber faced, insuring good suction. Both bottom and side suction types are supplied, the former for use with pipe and the latter with a hose; either 3-in. or 4-in. suction pipes may be obtained. One good feature of the arrangement of the side suction type is the placing of the intake on the opposite side of the pump from the discharge.

The only attention or expense required to operate this power outfit is to supply the necessary gasoline and lubricating oil. A ten-hour continuous run will consume approximately 2 quarts of gasoline, or at a total expenditure of not over 12 to 15 cents. Compare this cost with the operation of a hand bilge pump. The ordinary price paid will average about $2 per day each for 2 men; then if a steady pumping is required through the night at least 2 more men are required at $4. This makes a total of $8 for labor each 24 hours as compared to 30 cents for power in the case of the power pump. In addition to the cost factor the steady operation and the fact that superintendence is unnecessary in the case of the power pump, makes the advantage of this type of pump plainly evident.

Butt Welded Pipe Joints.

As the continuous welded rail is largely superseding the old loose method of connecting rails by fish plates and copper bands in street railway tracks, so does the butt weld for pipe joints bid fair to displace the old type screw joints in pressure pipe work. The Thermit pipe weld-

ing apparatus is doing much to aid this tendency.

By means of this apparatus the pipe may be welded after being put in place in its permanent position. All the pipe welding materials are portable, nothing being used that one cannot carry with ease. The joint obtained is of greater strength than the pipe itself, assuring safety in all cases where a heavy pressure is exerted on the pipe.

The resistance of the welded joint to all sorts of heavy stress is illustrated by an accident at the Essen Works of Messrs. Th. Goldschmidt. In this case a 7½-ton air receiver fell across several welded joint compressed air and steam pipes. These lines, however, were not broken nor torn, and it was possible to continue using them, though they were bent entirely to the ground a distance of 15 feet vertically and about 25 feet feet horizontally between two buildings.

The Thermit apparatus may be used to weld pipes up to 4 inch double extra heavy. This largest sized pipe was used in a pipe line made for the New York Central Railroad at its West Albany shops, on a pipe line carrying hydraulic pressure to a boiler shop. Thermit welded joints were used and in a test of 3,000 pounds pressure not a single flaw was developed in a ten-hour test, though the working pressure was only specified at 1,500 pounds per square inch for this pipe.

For specific information regarding this apparatus, address the Goldschmidt Thermit Co., 90 West street, New York.

The Moore Patent Snow Plow.

The Moore Specialty Manufacturing ing.
Company, of Detroit, Mich., has completed a factory devoted to the making of their patent snow plows. The great adaptability of the plow has made necessary this outlay for increased factory capacity, after three years of successful manufacture.

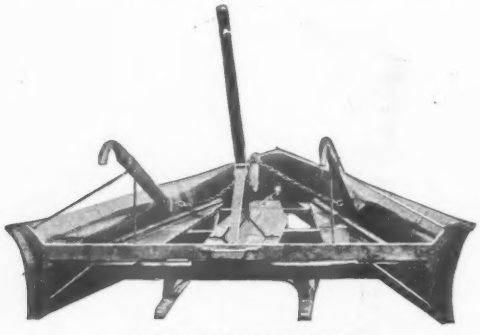
A reference to the accompanying photograph will indicate the points of particular merit in this plow. Seventeen strips of white pine, 2 inches by ⅞-inch, of the required length, are fastened together to form the concave mold boards, which by their design roll the snow away and prevent it from clogging, and thus dispense with the need of extra weight to hold the plow down. The mold boards are shod with the best steel and malleable iron.

By means of the lever shown at the center the operator may raise the plow so that it rests on the sled. This feature is of great value in transporting from place to place or in crossing curbs, ruts, side ditches, etc.

The plow is provided with either pole or shafts, which are hung on a swivel, making it easy to turn sharp curves. The excellence of design, insuring against clogging and the carrying of extra weight, makes it possible to operate the five or six-foot size through two or three feet of snow, with one horse.

The Moore special snow plows have a feature of adjustment that makes them of value for street or park work. A set screw adjustment is provided on the cross-bar so that the mold boards may be set to widths varying from six to eleven feet. By this arrangement the varying widths of park or cemetery drives may be taken care of. The Detroit Cemetery Association is using a Moore adjustable for their cemeteries and parks, because of its convenience, as their driveways and park drives vary considerably in width.

Full catalogues and prices may be obtained from the Moore Specialty Manufacturing Company, 601 Majestic building, Detroit, Mich.



THE MOORE SNOW PLOW.

Cement Statistics for 1909.

More cement was made and used in the United States in 1909 than in any preceding year, and the price per barrel was lower than ever before. The production in 1908 was 52,910,925 barrels, valued at $44,477,653; the production in 1909 was 64,196,386 barrels, valued at $51,232,979.

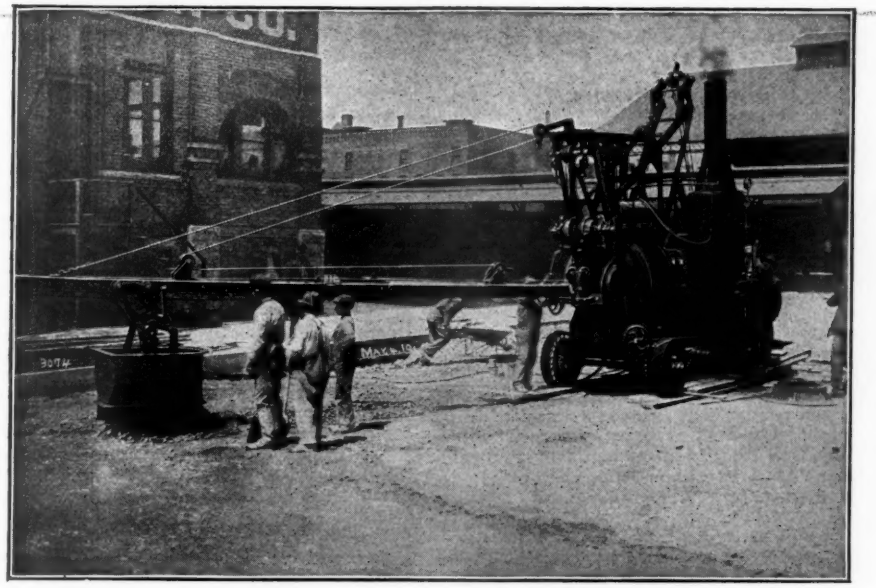
The increase was mainly in the output

of Portland cement—62,508,461 barrels, valued at $50,510,385, as against 51,072,-612 barrels in 1908, valued at $43,547,-679. The output of natural and puzzolan cement formed only a small percentage of the total cement production.

The average price of Portland cement per barrel in 1909 was less than 81 cents; the average price per barrel in 1908 was 85 cents. Portland cement cost $3 a barrel in 1880, but by reason of improvements in method of manufacture it can now be profitably sold for 80 cents a barrel.

In 1909 there were 103 Portland cement plants in operation, an increase of 5 over the number working in 1908. Of these plants 21 were in Pennsylvania, 12 in Michigan, 10 in Kansas, 8 in Ohio, 7 in New York, 6 in Indiana, 5 in Illinois, and 5 in California.

Most of this cement was used at home, for the United States has only a small export trade in cement, consuming from 1 to 3 per cent of the production. This country's immense natural resources of cement-making materials and its many well-equipped cement plants, however, should make it a strong competitor for the outside world's cement trade.



THE KOEHRING CONCRETE MIXER.

A Labor Saving Concrete Carrier.

A new feature of the Koehring concrete mixer (described in detail in MUNICIPAL ENGINEERING, vol. xxxxiii, p. 283) is attracting considerable attention among paving contractors. This innovation is of a nature that its value will be at once apparent. It consists of a delivering carrier to take the concrete from the machine and deposit it at will upon the street surface, saving by its operation the labor of seven men.

The carrier consists of a 20-foot boom attached to the machine in such a way that it may be raised or lowered and may be swung in an arc of 90 degrees about its fixed end. Upon this boom is swung a steel carrier with a double door bottom dump. This carrier is arranged on rollers so that it may be moved out along the beam by means of a cable operating over a reversible drum.

The method of operation is simple in extreme and requires only two men on the entire mixer force. One man takes care of the charging and another operates the discharge and delivery of the mixture. The carrier bucket is filled and moved out along the boom to the required position where a laborer whose work it is to spread the concrete, dumps the charge. The return of the carrier helps, in a degree, to spread the concrete, thus aiding the men alloted to this work.

The accompanying photograph shows one of the machines in operation. This particular machine has a record of 80,-000 yards laid, some of which was put in place at a cost as low as 4 3-10 cents per yard. Full catalogues and prices of the machines may be had of the Koehring Machine Co., Germania Bldg., Milwaukee, Wis.

Bitulithic Pavement in Oklahoma.

BY W. B. NEAL.

In the fall of 1901 a few of the citizens of Miami, Okla., believing that one of the best assets for a growing city is improved streets, started an agitation advocating the paving of Main street and Fourth street with a modern high-grade pavement. The efforts of a few who first advocated the improvement met with a hearty approval of the citizens, so that it was practically the unanimous sentiment of the community that we should improve our streets.

A joint committee of the city council and taxpayers was appointed. After careful investigation of all classes of pavements being laid in Oklahoma and adjoining states, including bitulithic pavements laid in Texas, the committee finally recommended the use of bitulithic pavement for the improvement to be made, regardless of the fact that representatives of rival pavements offered their products at lower prices.

In due course, after passing through the arduous route which paving proceedings have to take under the Oklahoma law, a contract was made aggregating approximately 28,000 sq. yds. in our city in the early summer of the present year, and the contractor, P. S. Kaull, completed the bitulithic pavement in the latter part of July. I believe that I can truthfully say that it is practically the unanimous opinion of our citizens that we have absolutely the best pavement that there is in the state of Oklahoma today. Of course, as is always the case, there were a few, and I am pleased to say a very few in this case, property owners who objected to the improvement being made, but I feel certain that even those few are now of the opinion that the city has gotten a first-class pavement and that it has not only made no mistake in providing for street improvements, but also in selecting the bitulithic pavement.

Miami was the pioneer city in Oklahoma to adopt bitulithic pavement for the improvement of its streets, but since that time I understand that Bartlesville has adopted this pavement and that the work at Bartlesville is now under construction. Doubtless next year will see a large increase of bitulithic pavement laid in the state of Oklahoma.

History of the New York-Port Huron Roller.

The New York-Port Huron roller was designed in the year 1905-6 by Charles Longenecker, M. E., and E. T. Wright, M. E. The experience of Mr. Longenecker included the designing of the Harrisburg roller, and several years with that company at Harrisburg, Pa. He was vice-president of the Weston Engine Company, Painted Post, New York, for several years after leaving the Harrisburg Foundry and Machine Company.

Mr. Longenecker became a member of the firm of Julian Scholl & Co., of New York, some time prior to the year 1890, and that firm took the agency of the Kelley-Springfield rollers in New York and other eastern states. After the sales agreement or territory arrangements between the Kelley and Pitts and the Harrisburg companies, and loss by Julian Scholl & Co. of the agency of the Kelley, Mr. Longenecker, in collaboration with Russell & Co., Massillon, O., designed and placed on the market the Russell roller; this was in about the year 1895. They continued marketing the Russell roller until the year 1901, when Russell & Co. sold their roller business to the Kelley-Pitts combination. In the years 1902-3 Mr. Longenecker had the sale of the Pitts roller in southern New York and in the New England states. In 1904 Mr. Longenecker began the development of the larger sizes of universal roller made by Julian Scholl & Co. In May, 1905, he left Scholl & Co. and in December, 1905, he organized the Chas. Longenecker & Co. firm, and commenced the development of the New York roller and the New York scarifier.

Mr. Wright's experience in the roller business commenced in England. He served his apprenticeship with the Aveling & Porter Co., of Rochester, England, the first manufacturers in the world of what is nowadays known as the Standard road roller, and now the largest makers in the world of steam road rollers. From Rochester, England, Mr. Wright came to Harrisburg, Pa., and in the draughting room of the Harrisburg Foundry & Machine Company at the time the Harrisburg roller was designed. Later he was for nine years with the Kelley-Springfield Company, then called the O. S. Kelley Company. In 1903 he went with the newly formed American Road Roller Company, and then designed the American, now known as the Monarch roller. In November, 1905, he became associated with Mr. Charles Longenecker and was associated with him in the design of the present New York roller, which has lately been purchased by the Port Huron Engine & Thresher Company, Port Huron, Mich.

Trade Publications.

"The Bar That Never Failed," is devoted to the description of the M-B reinforcing bar, and its use in various buildings. Special locking and spacing devices and formulae and tables for computing reinforcement supplement the regular catalogue features of the book.

The A. S. Aloe Company, of St. Louis, have issued a bargain circular giving special prices on various engineering supplies, instruments, etc.

"Sluice Gates and Other Water Works Appliances" is the subject of a 35-page illustrated catalogue of the Coldwell-Wilcox Company, of Newburgh, N. Y. Complete details and tables of the appliances are given, as well as the half-tones common to such catalogues.

The New York Bridge and Iron Company have a small catalogue describing Paradigm skylights, Simplex-Duplex interlocking steel stairs, and various other steel building sundries.

Keuffel & Esser Company, Hoboken, N. J., issue a circular descriptive of the Payzant (freehand) lettering pen, a device for making block or other heavy letters with a single stroke. The same company also has an improved theodolite with an 8-inch horizontal limb.

The Modern Iron Works, of Quincy, Ill., issues a booklet descriptive of a sewage disposal system for suburban residences, hotels, colleges, prisons, etc., not accessible to public sewers. The method is by intermittent surface or subsurface irrigation.

The International Harvester Company, of Chicago, has instituted a service bureau to cover the field and problems of farm-

The International Asphalt Company, of Chicago, have a leaflet descriptive of Cubanel, a road binder made from Cuban asphalt.

Bulletin No. 42 issued by the Jeffrey Manufacturing Co., of Columbus, is devoted to the description and illustration of coal handling and mine equipment machinery. It is very complete in detail and is illustrated by photographs of installations now in use. Booklet 28 issued by the same company deals with conveying machinery for handling stone, sand, gravel, ores, etc. This booklet is also illustrated in a very complete manner. Bulletin No. 42 and Booklet 28 may be obtained by writing The Jeffrey Manufacturing Co., Columbus, O.

The National Brake and Electric Co. have issued an illustrated book on motor and belt-driven air compressors. Tables of dimensions, capacities and other data of value are included in the book.

The Vulcanite Portland Cement Co. issues a printed leaflet entitled "Things Worth Knowing About Concrete." The latest edition includes a method of bonding new concrete to old and also the sodium silicate method of preventing dusting or easy erosion of concrete floors.

"What is asphalt?" is the question answered by a booklet of that title issued by The Texas Company. The term asphalt is defined and the difference between asphalt and the bitumens is made clear in this discussion. The method used by The Texas Company in preparing their products is taken up and described.

Trade Notes.

BITULITHIC.

Trenton, N. J.—By a unanimous vote, the street committee of common council accepted the Princeton avenue bitulithic pavement. Chairman Wiggins said he was satisfied that the work had been well done; Mr. Mayers called attention to the fact that the city was protected by a five years' guarantee, and City Engineer Swan, who had inspected the work daily during its progress, said that the specifications had been followed in all particulars. Mr. Mayers made the motion to accept the pavement and Mr. Plant seconded it. Mr. Reichert, the minority member of the committee, who resides in the Fifth ward, through which the pavement runs, joined his colleagues in declaring that the pavement was satisfactory.

BRICK.

Rich Hill, Mo.—The work of rebuilding the vitrified brick and tile plant, recently destroyed by fire, has begun.

CEMENT.

Sanders, Me.—The Roman Artificial Stone and Tile Co. has been organized to deal in Portland cement, concrete, etc. Samuel Clark, pres., Kennebunk, Me.

CONCRETE BLOCKS.

Arlington, O.—The Arlington Cement Tile Co. has been incorporated by Wm. Rinehart, George Kimmell, G. W. Myers, and P. J. Dillman.

Wichita, Kan.—The Wichita Cement Brick and Supply Co. has been incorporated by John Tracy, Miller Dobbin, J. C. Pierson and others.

PURCHASE OF MACHINERY.

Birmingham, Ala.—Special.—J. A. Montgomery, 905 First National Bank building, desires to purchase a standard drill, oil or gas.

Chanute, Kan.—Special.—J. S. Rustamier, 10 North Grant street, advises us that he may be in the market for a 30 or 40-h.p. road engine, double cylinder.

Grants Pass, Ore.—This city will vote on the question of purchasing a steam roller, at a cost of about $2,400.

LIGHT, HEAT AND POWER.

Atlantic Highlands, N. J.—The Monmouth Shore Gas Co. has been incorporated to operate gas works, by H. E. Woodman, A. M. Worstall, both of Real Estate Trust building, Philadelphia, and Harry Stille, Clayton, N. J.

Dover, Del.—The Cities Service Co., New York City, has filed articles of incorporation here, to operate works, plants, etc., for the generation and purification of natural and artificial gas and to lay mains, pipes and conduits, for its distribution for lighting, heating and power, or any other use to which gas may be applied. The incorporators are Anselm P. Anderson, New York City, and James M. Satterfield and Artly B. Magee, of Dover.

MISCELLANEOUS.

Chicago, Ill.—The Illinois Cast Iron Pipe and Foundry Co. has been incorporated by A. M. Osburn, W. M. Umbdenstock and A. G. Bower.

Evansville, Ind.—The Anchor Roofing and Paving Co. has changed its name to the Anchor Concrete Construction Co.

SEWER PIPE AND DRAIN TILE.

Williamsburg Va.—W. L. Jones has erected the first drain tile plant in eastern Virginia.

Patents Concerning Construction and Operation of Water Plants.

864,151. Manual Scraping Machine (for removing material from filters). Hiram W. Blaisdell, Los Angeles, Cal.

875,002. Valve for Stand Pipes. Wm. H. Sellow, Detroit, Mich.

878,960. Shell Dam (concrete). Edwin B. Jennings, New York, N. Y.

886,798. Fire-Hose Bridge. Robert C. Groh, St. Paul, Minn.

890,598. Wall Strainer. Arthur M. Brown, Houston, Tex.

894,220. Device for Cleaning Water Mains. John Maslin, Jersey City, N. J.

894,873. System of Cleaning Filters. Hiram W. Blaisdell, Los Angeles, Cal.

897,755. Combined Fresh and Salt Water Hydrant. Frank Malloye, San Francisco, Cal.

899,703. Dam. Wm. M. Ransom, Warren, R. I.

902,733. Dam (concrete). John F. Jackson, Houghton, Mich.

905,906. Water Meter. Sylvester L. McAdams, Beaver Falls, Pa.

905,915. Hydrant. Denis F. O'Brien, Newark, N. J.

907,328. Molded Strainer or Screen for Wells, Filters and the Like. John R. Freeman, Providence, R. I. (Concrete.)

908,058. Removing Sludge from Sedimentation Basins and Reservoirs. David C. Williamson, New York, N. Y.

910,495. Means for the Purification of Water. Douglas L. V. Browne, San Francisco, Cal.

910,687. Flexible Pipe Joint. Charles H. Jenkins, Louisville, Ky.

911,609. Deep Well Pump. Robert C. Purcell, Oakland, Cal.

912,885. Reinforced Concrete Water Pipe or Conduit. John M. Phelan, Jackson, Mich.

913,123. Double Acting Deep Well Pump. Jas. Gleason, Green Bay, Wis.

914,399. Water Power System. Salathiel C. Fancher, Kansas City, Mo.

914,559. Dam (concrete). Wm. G. Fargo, Jackson, Mich.

12,932 (Reissue). Distributing Machine for Closed Filters. Hiram W. Blaisdell, Los Angeles, Cal.

917,918. Water Purification System. John F. Wixford, St. Louis, Mo.

918,678. Reinforced Cement Sectional Conduit. Hugh J. Keenan and Edmund J. Tobin, Jackson, Mich.

923,831. Dam. Newton L. Hall, San Diego, Cal.

923,985. Dam and Method of Building the Same. Daniel E. Moran, Mendham, N. J.; John W. Doty, Edwin S. Janett, New York, N. Y.

924,682. Method of Washing Filter Sand. P. J. A. Maignen, Philadelphia, Pa.

928,663. Hydrant. Geo. W. Johnston, Springfield, Mass.

928,863. Cleaner for Mains and Pipes. Hugh A. Greenan and Frank O. Redford, Louisville, Ky.

929,110. Device for Cleaning Pipe Lines. Edward R. Reese, Tamaqua, Pa.

931,032. Filtering Bed. Paul F. Bussman, Buffalo, N. Y.

935,637. Method of Purifying Water. Wm. B. Ball, Chicago, Ill.

937,210. Process of Preparing Potable Water. John T. Harris, New York, N. Y.

942,436. Cement Lined Pipe and Fittings. Frank H. Caney, Newton, Mass.

944,527, 944,528. Method of and Apparatus for Cleansing Filter Beds. Zdenko von Wessely, Prague, Austria-Hungary.

945,596, 945,597. Street Valve and Fire Plug Boxes. Edward Prendergast, St. Louis, Mo.

945,971. Device for Cleaning Pipe Lines. John Maslin, Jersey City, N. J.

950,270. Meter Box. Lewis P. Andrews, Sedalia, Mo.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Regina, Sask.—Voted to issue $132,000 pavement bonds.

Iowa City, Ia.—Paving is contemplated for Washington st.

Little Rock, Ark.—Rock and Scott sts. are to be paved with asphalt concrete.

Lockhart, Tex.—Will vote in October on issue of $50,000 road bonds.

Duluth, Minn.—Tar macadam paving is contemplated for Eleventh ave., E., next year.

Kalispell, Mont.—Council contemplantes paving Main and other streets next spring.

Vancouver, B. C.—The city engineer estimates the cost of paving Broadway at $167,099.

North Yakima, Wash.—An appropriation of $40,000 for street work next year is contemplated.

San Angelo, Tex.—Will vote on the issue of $20,000 bonds for paving Chadbourne st.

Kennewick, Wash.—A resolution has been passed providing for grading and macadamizing A st.

Temple, Tex.—Paving is contemploted for about 1 mi. of residence streets. Cy. Engr. Smith.

Brazil, Ind.—Bids will be asked soon for improving Hendrix st. with crushed stone. Cy. coun.

Virginia, Minn.—A petition has been submitted to council asking for the paving of Walnut st.

Algona, Ia.—Council has authorized the construction of brick, cement block, or cement sidewalks.

Cincinnati, O.—Will vote in November on issue of $800,000 bonds for grade crossing elimination.

St. Petersburg, Fla.—Voted to issue $67,500 bonds for improving streets. M. W. Spencer, cy. engr.

Aitken, Minn.—The construction of cement sidewalks in Fourth and other streets is contemplated next spring.

Texarkana, Ark.—A paving district has been organized providing for creosoted blocks, asphalt or bitulithic paving.

Chisholm, Minn.—The construction of a road to the powder plant, 4½ mis. distant, is contemplated by the Commercial Club.

Hammond, Ind.—Remonstrances will be heard Oct. 3 on the proposed widening and extension of Calumet ave. Adam R. Ebert, chm. B. P. W.

Peoria, Ill.—Judge Siemmons, of the county court, overruled the legal objections raised by certain property owners

in the ordinance for paving Adams st., Sept. 23, and that thoroughfare will now be paved with creosoted wood blocks.

Springfield, Ill.—This city contemplates paving Spring, Pasfield, Edwards and a number of other streets. Frank H. Hamilton, cy. eng.

Cottonwood Falls, Kas.—The city council has adopted an ordinance providing that all old stone sidewalks are to be replaced with cement.

National City, Cal.—The bd. of trustees has ordered an election to vote upon a bond issue of $80,000 for street work and park development.

Brookfield, Mo.—A resolution has been approved providing for vitrified brick paving, curb and gutter in Monroe st. R. S. Brownlee, mayor.

Chester, Pa.—The construction of 3½ mis. of boulevard, extending from one end of the city line to the other, is contemplated. Frank W. Harrison, cy. clk.

Watertown, S. D.—Mayor Martin has appointed Aldermen Fahnestock, Lester and Hawley a committee to investigate the question of paving the business streets.

Buffalo, N. Y.—A resolution has been introduced directing Francis G. Ward, dir. pub. wks., to ask for bids for repaving Mohawk st. with asphalt and stone.

Walnut Grove, Ariz.—The residents have petitioned the board of supervisors for the construction of a wagon road from Prescott to this town. Address city clerk.

Youngstown, O.—A resolution has been passed to pave Williamson ave. Ordinances have also been passed to proceed with the paving of Woodhill ave. and Bryson st. A. W. Carver, mayor.

CONTRACTS TO BE LET.

St. Bernard, O.—Bids are asked until Oct. 3 for grading. Geo. Schroeder, vil. clk.

Peru, Ind.—Bids are asked until Oct. 6 for constructing 2 roads. Chas. Griswold, co. audt.

Franklin, Ind.—Bids are asked until Oct. 15 for constructing a highway. Wm. B. Jennings, co. audt.

Vincennes, Ind.—Bids are asked until Oct. 2 for constructing 3 gravel roads. J. F. Scott, co. audt.

Kokomo, Ind.—Bids are asked until Oct. 5 for constructing a gravel road. A. B. Easterling, co. audt.

Sullivan, Ind.—Bids are asked until Oct. 4 for constructing 3 rock roads. Ben C. Crowder, co. audt.

Rensselaer, Ind.—Bids are asked until Oct. 4 for constructing 5 stone roads. Jas. N. Leatherman, co. audt.

Winamac, Ind.—Bids are asked until Oct. 4 for constructing gravel roads. Ellis S. Rees, co. audt.

Grand Rapids, Minn.—Bids are asked until Oct. 5 for constructing a highway. M. A. Spang, co. audt.

Scottsburg, Ind.—Bids are asked until Oct. 4 for constructing 4 gravel roads. Frank Gardner, co. audt.

Spencer, Ind.—Bids are asked until Oct. 4 for constructing a macadamized road. Geo. W. Edwards, co. audt.

Peru, Ind.—Bids are asked until Oct. 6 for constructing 2 roads. Chas. Griswold, co. audt.

Scottsburg, Ind.—Bids are asked until Oct. 3 for constructing 4 gravel roads. Frank Cardner, co audt.

Knox, Ind.—Bids are asked until Oct. 3 for improving 2 roads. Lee M. Ransbottom, co. audt.

Ames, Ia.—Bids are asked until Oct. 12 for paving an alley with vitrified brick blocks. A. B. Maxwell, cy. clk.

Noblesville, Ind.—Bids are asked until Oct. 6 for constructing a gravel road on line between Marion and Hamilton cos. Geo. Griffing, audt. Hamilton co.; Albert Sahm, audt. Marion co.

Brazil, Ind.—Bids are asked until Oct. 7 for constructing a road in Harrison twp. Jas. L. Burns, co. audt.

Jefferson, Mo.—Bids are asked until Oct. 3 for curbing, guttering and macadamizing Clark ave. E. F. C. Harding, cy. engr.

Kokomo, Ind.—Bids are asked until Oct. 5 for constructing 3 mis. of gravel road. A. B. Easterling, co. audt.

Ft. Dade, Fla.—Bids are asked until Oct. 5 for constructing brick or concrete roads and concrete walks. Constr. Q. M.

Harrisburg, Pa.—Bids are asked until Oct. 6 for constructing 3 mis. of gravel road. Jos. W. Hunter, state highway comr.

Peoria, Ill.—Bids are asked until Oct. 15 for resurfacing Perry ave. with asphalt. Geo. E. Simmons, prest. bd. local impvts.

St. Augustine, Fla.—Bids are asked until Oct. 4 for constructing a public highway. B. Genovar, chm. co. comrs.

Wilmington, N. C.—Bids are asked until Oct. 15 for grading, paving and curbing certain streets. Louis S. Beldon, chm. st. comn.

Greencastle, Ind.—Bids are asked until Oct. 3 for constructing a macadam road. D. V. Moffett, co. audt.

Boonville, Mo.—Bids are asked until Oct. 3 for constructing a concrete sidewalk in Spruce st. Chas. G. Miller, cy. clk.

Toledo, O.—Bids are asked until Oct. 3 for paving 19th st. with vitrified paving blocks on concrete. Fred Shane, secy. B. P. S.

Hammond, Ind.—Bids are asked until Oct. 5 for constructing cement sidewalks in Ames and Walnut aves. Adam R. Herbert, chm. B. P. W.

Santa Barbara, Cal.—Bids are asked until Oct. 3 for grading sections Nos. 4 and 5 of Coast road, in road dist. No. 3. A. A. Hunt, co. clk.

Princeton, Ind.—Bids are asked until Oct. 5 for constructing 4 gravel roads. Joseph P. Yochum, chm. co. comrs.; Wm. T. Roberts, co. audt.

Birmingham, Ala.—Bids are asked until Oct. 5 for certain brick paving, street grading, retaining walls, etc. Maury Nicholson, cy. engr.

Ft. Still, Okla.—Bids are asked until Oct. 15 for grading roads and constructing concrete walks in new Artillery Post. Capt. David L. Stone, Constr. Q. M.

Lafayette, Ind.—Bids are asked until Oct. 5 for constructing 2 mis. of gravel on Island road, and 2¾ mis. macadam in Riverside road. A. G. Arnold, co. engr.

Lockland, O.—Bids are asked until Oct. 3 for paving Wayne ave. with vitrified brick, with concrete curbs, gutters, and crosswalks. C. E. Troy, vil. clk.

Ridgefield Park, N. J.—Bids are asked until Oct. 3 for paving with Amiesite macadam, grading, curbing, manholes, etc. E. S. Carr, prest. bd. vil. trustees.

Spokane, Wash.—Bids are asked until Oct. 5 for cleaning, grubbing, grading and draining state roads Nos. 10 and 16. Henry Bowlby, secy. state highway bd., Olympia.

Shelbyville, Ind.—Bids are asked until Oct. 6 for constructing cement sidewalks in Franklin st. and cement curbs and gutters in Walnut st. L. E. Webb, cy. clk.

Cincinnati, O.—Bids are asked until Oct. 4 for macadamizing 2.9 mis. of road in Whitewater twp. Stanley Struble, prest. co. comrs.; Jas. C. Wonders, state highway comr.

Fostoria, O.—Bids are asked until Oct.

17 (corrected date), for paving 6 streets with brick or bitulithic, with concrete and stone curbing. Chas. Latshaw, cy. engr.

Red Lake Falls, Minn.—Bids are asked until Oct. 7 for constructing 8,000 sq. ft. cement sidewalk, 400 ft. curb, and a reinforced concrete retaining wall at the court house. A. A. Latendress, co. audt.

Crookston, Minn.—Bids are asked until Oct 11 for paving Houston ave. and S. Ash, E. Fletcher, E. Robert, E. 2nd and E. 3rd sts. with asphalt, creosoted blocks, donnelite, and granitoid. A. M. Childs, cy. clk.

La Mowe, N. D.—Bids are asked until Oct. 4 for grading the grounds around the court house, involving the moving of 10,500 sq. yds. of earth, and constructing a driveway and curb. C. J. Alister, co. audt.

Toledo, O.—Bids are asked until Oct. 10 for treating the stone improvement, Brown road, with 3 applications of carbovia No. 2; until Oct. 14 for the repair of stone road No. 29; until Oct. 19 for grading, draining and macadamizing Glendale ave. Chas. J. Sauzenbacher, co. audt.

CONTRACTS AWARDED.

Carrollton, Mo.—J. C. Sykes was awarded a contract for brick paving for $83,440.

Scranton, Pa.—The contract for constructing 2 mls. of macadam road was awarded to W. W. Cobley.

Ocean Park, Cal.—L. Pearson & Co. was awarded a contract for improving Indiana ave. for $7,060.

Grants Pass, Ore.—Warren Construction Co. has been awarded contract for 3,500 sq. yds. bitulithic pavement.

York, Pa.—Standard Bituilithic Paving Co. was awarded the contract for paving Duke st. at $2.23 a sq. yd.

Pasadena, Cal.—The contract for improving El Molino ave. was awarded to Jas. M. Montgomery, for $10,492.

Memphis, Tenn.—The contract for paving East st. was awarded to the Memphis Asphalt Co., for $22,143.

Newark, N. J.—Wm. Ballard was warded the contract for grading and curbing S. 12th st., for $4,440.

Parsons, Kas.—Hardman & Gaffery secured the contract for curbing and guttering and macadamizing Clark ave.

Muncie, Ind.—The contract for constructing a public highway was awarded to Daniels & Lyst, of Anderson, Ind.

Memphis, Tenn.—The contract for paving Anderson st. was awarded to H. P. Streicher & Co., of Toledo, for $3,850.

Ambridge, Pa.—The contract for paving was awarded to the George B. Patterson Co., of East Liverpool, O., for $5,000.

Schenectady, N. Y.—The contract for paving Wall st. was awarded to the Schenectady Constructing Co., 332 State st.

Corvallis, Ore.—Contract for 44,000 sq. yds. bitulithic has recently been awarded to Warren Construction Co.

Florence, Ala.—The contract for paving Walnut st. with crushed limestone was awarded to J. H. Angel, for $8,000.

Vincentown, N. J.—The contract for constructing a stone road was awarded to E. C. Humphrey, of Hackensack, for $22,452.

Klamath Falls, Ore.—The Warren Construction Co. has been awarded contract for paving with bitulithic, 50,000 sq. yds.

Leadville, Colo.—The Municipal Construction Co. was awarded a contract for paving Montclair Parkway, for $98,750.

Erie, Pa.—Lininger & Bennett, of Conneaut, O., secured the contract for 10,000 ft. of concrete curb and gutter.

Cincinnati, O.—The John Ruebel Construction Co., Hayes ave., Cincinnati, was awarded a contract for improving the Harrison and New Haven road, for $29,267.

Riverside, Cal.—Oscar Ford was awarded a contract for constructing 4 mls. of the Big Springs Canyon road, for $17,950.

Twin Falls, Idaho.—F. W. Whittier was awarded a contract for 84,000 sq. ft. of concrete paving, at 13 cts. a sq. ft.

Albert Lea, Minn.—The contract for curbing College st. was awarded to the Albert Lea Construction Co., for $3,929.17.

Reading, Pa.—John E. Weidner was awarded a contract for paving Plum st. with vitrified blocks, at $1.91 a sq. yd., or $900.80.

Duluth, Minn.—John A. Johnson was awarded a contract for paving Irving Place, 7th and Clover st. with granitoid blocks, for $27,033.

Chattanooga, Tenn.—The West Construction Co. was awarded the contract for grading McCallie ave. preparatory to paving, for $9,407.

Portland, Ore.—Contracts for paving with bitulithic aggregating 80,000 sq. yds. have been awarded to the Warren Construction Co.

Columbus, O.—The contract for paving N. High st. with asphalt was awarded to the Andrews Asphalt Paving Co., Sept. 15, for $70,000.

Sullivan, Ind.—The contract for constructing a stone road in Cass twp. was awarded to Ward Hawkins, of this city, for $8,240.

Marion, Ind.—The contract for paving 9th st. with macadam was awarded to Davidson & Bangher, of Windfall, Ind., for $26,847.

Chelan, Wash.—The Eagle Transfer Co., of Wenatchee, was awarded the contract for constructing 5 mls. of state road No. 10.

Taylor, Tex.—The contract for constructing macadam roads was awarded to the Texas Building Co., of Ft. Worth, for about $200,000.

Rome, N. Y.—Contracts have recently been awarded to the Warren Bros. Co. for paving E. Willett and Elm sts. with bitulithic.

Youngstown, O.—The improvement of the Petersburg and Youngstown road was awarded to G. A. Garfield & Co., of Girard, O., for $14,820.

Herkimer, N. Y.—Warren Bros. Co. has recently been awarded additional contract in Herkimer for paving Prospect st. with bitulithic.

Klamath Falls, Ore.—The contract for bitulithic paving was awarded to the Warren Bros. Construction Co., 59 Temple st., Boston, at $2.20 a sq. yd.

Brantford, Ont.—Contract for paving Darling st., from George to Market, with bitulithic has been awarded to the Warren Bituminous Paving Co.

Newark, N. J.—The contract for paving 4 mls. of Pleasant Valley Way with telford was awarded to Robert Doriety, 29 Highland ave., for $29,624.95.

Kansas City, Kan.—Contract for paving Quindaro Boulevard, from 17th to 19th st., was awarded to the Kansas Bitulithic Co., 5,850 sq. yds.

Columbus, O.—Contracts have been awarded as follows: Tar binder on Chillicothe road, Foley Bros., $8,000; macadamizing Clinkinger road, Yardley & Wilson, $4,000.

Toronto, Ont.—The Warren Bituminous Paving Co. has been awarded contract for paving Marshall st., from Block ave. to Sheridan st., with bitulithic.

Indianapolis, Ind.—Contracts have been awarded as follows: Paving Washington Boulevard, from 36th to 40th sts., with asphalt, brick gutters and curbing, Union Asphalt Co., $6.51; resurfacing E. Wash-

ington st., Marion County Construction Co., $4.10 a lin. ft.

Dayton, O.—David Beard has been awarded paving contracts as follows: Wyoming st., two sections, $11,716 and $3,697; Burns ave., $9,035; Logan ave., $2,476; 6th st., $3,060.

Chicago Heights, Ill.—Paving contracts have been awarded as follows: Lowe ave., G. H. Myrick, of Chicago, $5,800; Wallace st., Chicago Heights Coal Co., $5,975.

Milwaukee, Wis.—The contract for the permanent improvement of North st. and West ave. was awarded to G. H. Stanchfield, of Fond du Lac, at $1.91 per ft., or $15,561.57.

Scarsdale, N. Y.—W. H. McCabe, of White Plains, N. Y., was awarded the contract for resurfacing with bituminous macadam the New York Port road, in this town, for $20,000.

Richmond, Cal.—Contracts for macadam paving have been awarded as follows: 12,332 sq. yds. in 5th st., Geo. Galbraith, $13,919; 20,533 sq. yds. in Ohio st., J. J. Davies, $17,886.

Corvallis, Ore.—The Warren Construction Co., 59 Temple st., Boston, was ton, Jefferson, Monroe and 3rd sts. with bitulithic, for $200,000.

Ft. Du Pont (Delaware City, P. O.), Del.—H. C. Clark, of Delaware City, was awarded the contract for macadamizing 1,929 sq. yds. of Post Penn. road, adjacent to this post, at $1.29 a sq. yd.

Boston, Mass.—L. C. Carchis was awarded the contract for constructing a state highway in Ewing, for $8,711. The contract for a state highway in Franklin was awarded to C. E. Horne, for $5,273.

Atlantic, Ia.—The contract for constructing 41 blocks of asphalt macadam paving was awarded to the Capital City Co., for $97,000, and the contract for curb and gutter to Wm. Horrabin, for $14,000.

Elizabethtown, Pa.—The contract for building a macadamized road, a water plant, a concrete bridge, and 2 mis. of cobble gutters was awarded to John Goll & Co., 1539 Filbert st., Philadelphia, for $51,676.

Cambridge, Mass.—The city of Cambridge has recently awarded contract to the Warren Bros. Co. for paving such streets as may be designated by the Superintendent of Streets during the season of 1910 with bitulithic.

Rochester, N. Y.—Contracts for brick paving have been awarded as follows: Genessee st., Whitmore, Rauber & Vicinus, 274 South ave., $21,541; Arnett st., Hagaman, Miller & Hagaman, 16 State st., $52,012.

New Albany, Ind.—The contract for constructing sidewalk improvements for the remainder of the year was awarded to Wm. O. Sweeney, of Jeffersonville, at 14¾ cts. a sq. ft. for sidewalks and 3¾ cts. a sq. ft. for grading and sodding grass plots.

St. Louis, Mo.—The following contracts for paving with bitulithic have been awarded to the Granite Bituminous Paving Co.: Arsenal st., 8,630 sq. yds.; Semple st., 5,998 sq. yds.; Union st., 10,003 sq. yds.; Bent ave., 4,780 sq. yds.; Porlis, 3,477 sq. yds.

Massillon, O.—Paving contracts have been awarded as follows: E. Cherry and N. Erie sts., Philip Diefenbacher & Lewis; Pearl and Dwight sts., Geo. P. Williams; Wissman, S. Waechter, Green and Walnut sts. and Woodland and Commonwealth aves., Urban & Schott.

Ft. Dodge, Ia.—The Bryant-McLaughlin Asphalt Paving Co. was awarded the contract for paving 1st ave., 16th and 13th sts. with asphalt, as follows: Paving, $1.98 a sq. yd.; extra grading, 39 cts. a cu. yd.; overhaul of — ct.; restoring old curbs, 20 cts a lin. ft.; building combined Portland cement curb and gutter, 65 cts. a lin. ft.; street railway paving, $3.19 per sq. yd.

Springfield, O.—Edward Ryan was awarded the contract for E. High st. and College ave., of this city, for $24,878 and $11,167. The material to be used will be Trinidad Lake asphalt, with Nelsonville block between the car tracks set in asphalt filler.

Los Angeles, Cal.—C. Strausburg, H. W. Heilman Bldg., was awarded a contract for constructing 1 mi. of new streets in one of the Briggs Co.'s tracts at 2nd and Harvard sts., for $15,000. The streets will be graded and graveled, and cement sidewalks, curbs and gutters constructed.

Wichita, Kas.—The Cleveland-Trinidad Paving Co. will be awarded the contract for paving Riverside ave. with asphalt, as follows: Curb, 23c; gutter, 33c; excavating, 45c; asphalt, $1.99. The Warner-Quinlan Co. bid: Curb, 25c; gutter, 35c; excavating, 45c; asphalt, $2.

Lafayette, Ind.—Contracts for constructing gravel roads have been awarded as follows: Frisby road in Washington twp., to James F. Pierce, at $3,500; the Middleton road in Wabash twp. and the Mathier road in Shelby twp., to Snyder & Jenkins, of Frankfort, Ind., at $4,375 and $3,596, respectively.

Crown Point, Ind.—Contracts for constructing 6 gravel roads have been awarded as follows: Three to Nejdl & Greenwald, Whiting, Ind., $4,049, $7,550 and $15,900; one to Wm. Ahlbourn Construction Co., Hammond, Ind., $3,760; two to Downey & Portz, St. John, Ind., $16,400 and $19,100.

Billings, Mont.—The contract for constructing cement sidewalks, curbs and alley crossings in dists. Nos. 59, 61 and 62 was awarded to S. R. Birch & Sons, of Salt Lake City, as follows: Cement sidewalk, 15.4 cts. a sq. ft.; curbs, 43 cts. a lin. ft.; alley crossings, 30 cts. a lin. ft. Thos. Moore was awarded a contract for alley crossings and driveways in dist. No. 60, at 20.5 cts a sq. ft.

Oklahoma City, Okla.—(Special). Bids were submitted, Sept. 19, for street paving and contracts will probably be awarded as follows: Cleveland-Trinidad Paving Co., asphalt—1st. st., $45,582.30; Pottawatomie ave., $34,382.70; Western Paving Co., asphalt—Avenue B, $44,846.65; 9th st., $44,714.72; Avenue A, $142,863.36; 26th st., $88,822.72; Military ave., $52,-815.48; Main st., $33,610.18; 24th, 25th, 26th and Broadway sts., $21,947.88; Putnam Heights boulevard, $4,268.69. F. P. McCormick, asphalt—Linwood blvd., $76,-258.81; Agnew st., $16,166.53. Shelby-Downard Co., Ardmore, Okla., Ardmore rock asphalt—11th st., $2,179.91; Central ave., $9,131.88; 7th st., $9,584.97; Dewey st., $19,150.42; Noble ave., $6,174.81; 7th st., $6,424.32; Lee ave., $7,613.71; Central ave., $4,739.71; Walnut ave., $16,-657.31; 12th st., $2,544.12.

Columbus, O.—Bids were submitted, Sept. 3, for improving N. High st., as follows: Wood block—U. S. Wood Preserving Co., $114,924; A. G. Pugh, Columbus, $117,925. Asphalt block—William H. Graham, Columbus, $102,526; A. G. Pugh, $111,958. Stone block—A. G. Pugh, Salisburg stone with cement filler, $137,-554; Salisburg stone with tar filler, $138,-202; Salisburg stone with asphalt filler, $147,598; William M. Graham, granite and Medina stone with tar and cement filler, $149,296; with asphalt filler, $154,-156; Salisburg stone with tar and cement filler, $154,156; with asphalt filler, $159,-016. Paving with brick—A. G. Pugh,

Fultonham block, $77,614; Harris block, $78,586; Portsmouth block, $79,234; Nelsonville block, $80,206; D. & D., $86,038. Paving with sheet asphalt—Andrews Asphalt Paving Co., Bermudez, $70,929; Cleveland Trinidad Paving Co., Cleveland, California Trinidad, $77,138; A. G. Pugh, Cubanel, $81,179; William M. Graham, California, $84,260.

Huntington, W. Va.—Paving contracts were awarded, Sept. 6, as follows: Fourth ave., from Eleventh to 16th sts., 14,170 sq. yds., Metropolitan brick, 4,810 lin. ft. of combined curb and gutter, to Freshwater & Son, of Chester, W. Va., at $21,241. Seventh ave., from Tenth to 16th sts., 14,210 sq. yds., Metropolitan brick and 5,825 lin. ft. of combined concrete curb and gutter, to Freshwater & Son, at $21,681. Eighth ave., from Twelfth st. to a point 230 ft. east of Smith st., 15,220 sq. yds. of Portsmouth granite, 7,300 lin. ft. of combined concrete curb and gutter, to Harrison & Dean, of Huntington, at $21,038. 20th st., from Eighth ave. to Ritter ave., 8,800 sq. yds. of Portsmouth granite, 4,000 lin. ft. of 6x8-in. edging, to Harrison & Dean, at $11,056. Van Buren ave., between 13th and 14th sts., west, and 13th st., west, from Van Buren ave. to the C. & O. R. R., 1,650 sq. yds. of Portsmouth granite, 1,180 lin. ft. of edging, to Ullom & Scanlon, at $2.25. Tenth st., between Sixth ave. and the C. & O. R. R., 2,450 sq. yds. of Metropolitan brick, 860 ft. of concrete curb and gutter, to Freshwater & Son, at $2,642.

Hartford, Conn.—Contracts for state road work have been awarded as follows: Beacon Falls—2,325 lin. ft. gravel-telford road, including three 15-in. and one 18-in. tile culverts, to Merritt & Bush, Stamford, Conn., $1.25 per lin. ft. for gravel; $2 for telford; $1.25 for rubble drain, and $6 per cu. yd. for masonry walls. Enfield—3,705 lin. ft. macadam-telford road on the Hartford-Springfield turnpike, to Amos D. Bridge's Sons, Inc., Hazardville, Conn., $2.49 per lin. ft. for macadam; $3.49 for telford; $1 for rubble drain, and $3 per sq. yd. for brick work. Cromwell—On the Hartford-Saybrook turnpike, to the Pierson Engineering & Construction Co., Bristol, Conn., for resurfacing about 4,200 lin. ft of road with a bitulithic treatment. Haddam—On the Hartford-Saybrook turnpike, to Roger Kennedy, for resurfacing about five miles of graded and gravel road with trap-rock splinters. Simsbury—1,562 lin. ft. macadam-telford road, to Antonio Vito, of Thompson, Conn., at $3.26 per lin. ft. for macadam; $3.76 for telford; 98 cts. for rubble drain; 75 cts. per sq. yd. for cobble gutters; $5.50 per cu. yd. for masonry walls. East Granby—4,668 lin. ft. macadam-telford road, including two 30-in. and two 15-in. tile culverts and one reinforced-concrete arch culvert, to Antonio Vito, Thompson, Conn., $5.76 per lin. ft. for macadam; $5.96 for telford; 98 cts. for rubble drain; $5.50 per cu. yd. for masonry walls. Bloomfield—20,908 lin. ft. macadam-telford road, including six 12-in., four 15-in., two 24-in., and two 18-in. tile culverts, to A. D. Bridge's Sons, Inc., Hazardville, Conn., $1.61 for macadam; $2.31 for telford; $1 for rubble drain, and $6 per cu. yd. for masonry walls.

SEWERS.

CONTEMPLATED WORK.

Fordyce, Ark.—Plans have been prepared for constructing sewers.

Bryan, Tex.—Mayor Maloney is in favor of constructing a sewerage system.

Tecumseh, Neb.—The construction of sewers is contemplated. H. J. Enders, mayor.

Portland, Ore.—A resolution has been passed providing for a sewer in Adler st.

The Dalles, Ore.—A sewerage system will be installed next spring, at a cost of $400,000.

Eveleth, Minn.—Bids will be asked soon for constructing 1,500 ft. of 6-in. pipe sewer.

Newark, Del.—Plans are being prepared for constructing sewers. Wilbur Wilson, cy. engr.

Buffalo, N. Y.—Plans are being prepared for the readjustment of the present sewerage system.

Briggs, Cal.—Plans are being prepared for constructing a sewerage system and disposal plant.

Clinton, Ia.—Resolutions have been adopted for constructing sewers in Twelfth ave. and Fifth st.

Pottstown, Pa.—Plans are being prepared for constructing a sewerage system and disposal plant.

Olympia, Wash.—An ordinance has been passed for constructing a trunk sewer. E. L. Van Eppe, cy. engr.

Toppenish, Wash.—Will vote in October on issue of $35,000 bonds for constructing a sewerage system.

Sharon, Pa.—Plans are being prepared for constructing a sanitary sewerage system and disposal plant.

Ft. Worth, Tex.—City Engr. Trammell has recommended the constructing of a storm sewer in Jarvis st.

Bridgeton, N. J.—Plans are being prepared for the construction of a trunk sewer. Jacob B. Jones, cy. clk.

Wilmington, Del.—The city council has appropriated $30,000 for constructing a sewer in the Ninth ward, west of Market st.

Schenectady, N. Y.—Plans for constructing a surface water sewer are being prepared by J. Leland Fitzgerald, cy. engr.

Orange, Cal.—Plans will be prepared and contracts will be awarded about Jan. 1 for constructing a municipal sewerage system.

Ocean Park, Cal.—An ordinance has been passed to build a sewer in Fifth and Pennsylvania sts. G. A. Murray, cy. clk.

Belle Plaine, Ia.—Surveys for a sewer outlet for the sanitary sewer system will be made by Engineer Hart, of Clinton.

Williamsport, Pa.—Plans for constructing the East End sewer will be prepared by Carroll P. Bassett, sanitary engr.

San Francisco, Cal.—Ordinances have been passed for constructing sewers in sections C and F of the North Point main sewer.

Pittsburg, Pa.—An ordinance has been passed authorizing the construction of a sewer in Lopey alley. E. J. Martin, clk. coun.

Carlisle, Pa.—The construction of sewers in Mully Grub and Spring sts., including disposal plant, is contemplated.

Westfield, N. J.—Voted to issue $100,000 bonds for constructing an adequate sewerage system and erecting a disposal plant.

Ontario, Cal.—A resolution has been passed for constructing a vitrified pipe sewer in an alley. R. O. Brackenridge, cy. clk.

Tacoma, Wash.—A resolution has been passed providing for a sewer in N. Sixth and N. Seventh aves. and L st. F. L. Davis, cy engr.

Steubenville, O.—A resolution has been passed providing for the construction of a sewer in N Sixth st. Hugh W. Paterson, cy. clk.

Dallas, Tex.—The bd. of city comrs. adopted, Sept. 16, a recommendation authorizing the city engineer to prepare

plans and specifications for constructing storm sewers northeast of Masten st., and extending east to the Houston and Texas Central tracks.

Lafayette, Ind.—Plans and specifications have been adopted for the construction of a sewer, and remonstrances will be heard Oct. 5.

Zanesville, O.—An ordinance has been passed providing for the construction of a storm and sanitary sewer in Pine st. Neil Starkey, cy. clk.

Alliance, O.—Plans have been prepared for constructing a storm sewer from the old fair grounds to Washington st. A. Q. Kotte, cy engr.

Bastrop, Tex.—A special committee has been appointed, consisting of several aldermen and citizens, to investigate the cost of installing a sewerage system.

St. Charles, Ill.—Plans for constructing a new sewerage system, including a large septic tank, have been prepared by Henry Allen, cons. engr., of Chicago.

Lestershire, N. Y.—The town board of trustees will pass a resolution authorizing the drafting of plans and specifications and asking for bids for the Main st. sewer extension.

Creighton, Neb.—The executive committee of the Commercial Club voted to install a sewerage system. A committee composed of the president and secretary was appointed to investigate the matter.

Wichita, Kan.—Resolutions have been passed providing for the construction of surface drainage, catch basins and sewer on Gilbert st. and lateral sewers in district "A," of sanitary sewer district No. 12. Wm. Sence, cy. clk.

St. Louis, Mo.—Special.—The construction of sewers during the next year is contemplated, as follows: second section Baden public sewer, approximate cost of $181,000; third section River des Peres foul water sewer, $365,000; second section Glaise creek joint district sewer, $150,000; Rock Creek joint district sewer, $180,000. Sewers will also be built in numerous small districts, contracts for which can be undertaken by any contractor.

CONTRACTS TO BE LET.

Washington, Ind.—Bids are asked until Oct. 3 for constructing a ditch. A. F. Annen, co. surveyor.

Pasco, Wash.—Bids are asked until Oct. 4 for constructing a sewerage system. L. D. Conrad, cy. clk.

Tama, Ia.—Bids are asked until 8 p.m., Oct. 3, for constructing a sewage pump or lift. Lee I Carson, cy. clk.

Frankfort, S. D.—Bids are asked until 8 p.m., Oct. 3, for constructing sewers. Robt. J. Dickson, cy audt.

Ames, Ia.—Bids are asked until Oct. 12 for constructing 788 ft. 8-in. pipe sewer. A. B. Maxwell, cy. clk.

Mayfield, Pa.—Bids are asked until Oct. 3 for constructing an underground sewer. Theodore H. Wachna, chm. borough coun.

Sac City, Ia.—Bids are asked until Oct. 3 for constructing a certain sewer or sewer outlet. W. H. Townsend, mayor.

East Grand Forks, Minn.—Bids are asked until Oct. 4 for constructing 760 ft. 10-in. sewer in S. Fifth st. Jas. Gorman, cy. clk.

Columbus, O.—Bids are asked until Oct. 5 for constructing sewers in a large number of streets. H. S. Holton, dir. pub. service.

New York City.—Bids are asked until Oct. 5 for constructing sewers in various streets in Brooklyn. Alfred E. Steers, prest. borough.

Chicago, Ill.—Bids are asked until Oct. 5 for constructing sewers in a number of streets. Albert F. Keeney, prest. bd. local impvts.

Brawley, Cal.—Bids are asked until Oct. 3 for furnishing plans and specifications for a municipal system. W. H. Whelan, cy. clk.

New York City.—Bids are asked until Oct. 5 for constructing sewers in various streets in Brooklyn. Alfred E. Steers, prest. borough.

Pipestone, Minn.—Bids are asked until Oct. 3 for constructing 2,036 lin. ft. sewers in dists. Nos. 8115 and 8116. S. W. Fund, cy recdr.

Forman, N. D.—Bids are asked uutil Oct. 3 for constructing a septic tank in the rear of the county court house. R. P. Irving, co. audt.

St. Cloud, Minn.—Bids are asked until Oct. 31 for constructing an addition to a sewer outlet in Fourth st. S. Earl C. Scott, cy. clk.

Fargo, N. D.—Bids are asked until Oct. 5 for constructing a 12-in. lateral sewer in Fifth ave. S., Twelfth and Fourteenth sts. E. R. Orchard, cy. audt.

Plainfield, N. J.—Bids are asked until 8 p.m., Oct. 3, for constructing sanitary sewers and pumping stations. Jas. T. MacMurray, cy. clk.

Oakland, Cal.—Bids are asked until Oct. 6 for constructing a storm sewer, with appurtenances, in Market and Seventh sts. Walter N. Fawcett, secy. B. P. W.

Sonyea, N. Y.—Bids are asked until Oct. 11 for alterations to the sewage disposal plant at Craig Colony for Epileptics. Percy L. Lang, prest. bd. mgrs.

Morrisonville, Ill.—Bids are asked until Oct. 8 for constructing 50,000 ft. 10 to 27-in. vitrified tile, 6 retaining walls, etc. John M. Becker, town clk.

Angleton, Tex.—Bids will be asked until Oct. 4 for constructing canals, drains, ditches and laterals in said drainage district. O. W. Willits, chm. drainage comrs.

Norristown, Pa.—Bids are asked until Oct. 12 for constructing a sanitary sewer and laterals. Chas. C. Rambo, sewer com.; S. Cameron Corson, borough engr.

Goshen, Ind.—Bids are asked until 3 p.m., Oct. 3, for constructing a 10-in. sanitary sewer in S. Tenth st., from Purl st. to Plymouth ave. Geo. H. Rempler, cy. clk.

Indianapolis, Ind.—Bids are asked until Oct. 3 for constructing a local sewer in the alley west of West st., from McCarty to Wyoming sts. C. A. Schrader, prest. B. P. W.

Marshall, Ill.—Bids are asked until Oct. 3 for constructing vitrified pipe sewers, 3 brick manholes, 4 brick catch basins, and 8 curb inlets. Seymour Hurst, chm. bd. local impvts.

Emmetsburg, Ia.—Bids are asked until Oct. 3 for constructing sewers, repairing 4,792 ft. salt-glazed vitrified pipe sewers, 11 manholes, and 5 flush tanks. T. E. Rutledge, cy. clk.

St. Clairsvile, O.—Bids are asked until Oct. 10 for constructing a sewerage system and septic tank at the Belmont county infirmary, 3½ mis. west of this city. E. C. Shepherd, co. audt.

Fostoria, O.—Bids are asked until Oct. 17 (corrected date), for constructing sewers in 5 streets, requiring 2,350 ft. 12-in. and 1,460 ft. 15-in. pipe sewers. Chas. Latshaw, cy. engr.

Mansfield, O.—Bids are asked until Oct. 4 for constructing a storm sewer in Bowman st., requiring 840 ft. 18-in., 56 ft. 12-in., 100 ft. 4-in. and 40 ft. 8-in. sewer, 3 storm manholes, 5 inlets, and 1 lamphole. John Cahall, dir. pub. service.

Muskogee, Okla.—Bids are asked until Oct. 17 for constructing a storm sewer in dist. No. 12, requiring 2,000 cu. yds. brick or concrete masonry, 20,000 cu. yds. excavation, and 16,000 ft. 12 to 33-in. tile sewers. Chas. Wheeler, Jr., cy. clk.

CONTRACTS AWARDED.

Wakefield, Mass.—Jas. L. Byrne was awarded the contract for the West Chestnut st. sewer extension.

Dubuque, Ia.—The contract for constructing a sanitary sewer in Grandview ave. was awarded to W. F. Hassett.

Chandler, Okla.—The contract for constructing a sewerage system was awarded to J. S. Smith & Sons, of Oklahoma City.

Winchester, Ky.—The contract for constructing a sewerage system was awarded to E. T. Lewis & Co., for about $60,000.

Clarksburg, W. Va.—The contract for a sewerage system was awarded, Sept. 15, to John I. Dick, of Scottsdale, Pa., for $20,000.

Duluth, Minn.—Adam McAdam was awarded the contract for constructing a sewer in Fifty-ninth and Sixtieth alleys, fifth division, for $8,180.

Janesville, Wis.—The contract for constructing 5,933 ft. of sewer in various streets was awarded to Andrew Thompson, of Racine, Wis.

Canton, O.—The contract for constructing a storm sewer in Liberty and Saxton sts. was awarded to Turnbull & Dehn, for $25,528.

Muscatine, Ia.—The contract for constructing sub-sewerage dist. No. 20 of Main 1 was awarded to August Korneman, for $4,020.12.

Dunkirk, N. Y.—E. J. Kuehn was awarded a contract for constructing a sewer in W. Front st., Bingham road, an extension of the Deer st. sewer.

Pasadena, Cal.—The contract for constructing a reinforced concrete storm sewer was awarded to M. L. Hostetter, of Los Angeles, for $162,800.

Roanoke, Va.—C. Marley was awarded the contract for constructing sewers in Wise, Campbell, Kirk, Church and Tazewell aves., for about $5,000.

Albany, N. Y.—The contract for building a sewer in the Manning boulevard was awarded to M. F. Dollard, for $2,108.27, and in the Northern boulevard for $3,150.

Carrington, N. D.—Gilbert Haggart, of Fargo, was awarded the contract, Sept. 10, for constructing a main sewer system and 1¼ mi. of water main extension, for $60,000.

Rochester, N. Y.—The contract for constructing a sewage disposal plant at the Monroe County Tuberculosis Hospital was awarded to Bert Warren, of Honeyoye Falls, N. Y., for $5,000.

Swift Current, Sask.—Laidlaw & MacDonald, of Ft. William, Ont., were awarded a contract for constructing sewers and water mains, for $39,180, and sewage disposal works for $8,249.

Salt Lake City, Utah.—Special.—Dale L. Pitt was awarded contracts, Sept. 19, for constructing sewers as follows: extension No. 221, 99 cts. a lin. ft.; exten. No. 274, $1.11 a ft.

Corvallis, Ore.—J. A. Saucet was awarded a contract for constructing an additional sewer to cover Job's addition, College Hill, and the southeastern part of the city, for $110,700.

Forest Hills (Flushing P. O.), N. Y.—The contract for constructing a 42 and 48-in. reinforced concrete storm water drain for the Sage Foundation Homes Co. was awarded to D. Cuozzo, Park Row Bldg., New York City.

Tulare, Cal.—The Stanley Constructing Co., of San Francisco, was awarded the contract for constructing a sewer system, for $19,820. The contract for furnishing the pipe was awarded to N. Clark & Son, of this city.

Baltimore, Md.—William Shipley, 3404 Chestnut ave., city, was awarded a contract for constructing a private sewer, for $4,000. B. F. Sweeten secured contracts for sewer construction, for $67,371, and the Dietz Engineering Co., of New York City, for $17,360.

Grand Forks, N. D.—J. M. Carroll & Sons have been awarded contracts as follows: Water main extension No. 71, lateral sewer No. 12, district 4; lateral sewer No. 14, district 5.

Pasadena, Cal.—The contract for constructing a sewer in Hill, Chester, San Pasqual and Division sts. was awarded to Peter Gribavach, for $9,190. Chamberlain & Williamson secured the contract for building sewers in El Molino, Van Wyck, Prescott, Washington and Douglas sts. for $5,000. M. L. Hostetter will build 14,500 ft. of reinforced concrete sewer in Brooklyn, for $162,600.

Hawarden, Ia.—Roberts & Few, of Brookings, S. D., were awarded a contract for sewer construction, as follows: 2,550 ft. 12-in. sewer pipe, $1.20; 800 ft. 10-in., 90 cts.; 15,000 ft. 8-in., 70 cts.; 46 manholes, each $60; lumber per M. ft., $40; syphon, complete, $305; flood gate, $49; total, $16,914.

WATER WORKS.

CONTEMPLATED WORK.

Tower, Minn.—A water works system is contemplated.

Hearne, Tex.—A water works system is contemplated.

Nome, N. D.—Voted to install a water works system.

Roluleau, Sask.—A water works system is contemplated.

Kinsley, Kas.—The extension of the water mains is contemplated.

Maumee, O.—The construction of a water works system is contemplated.

Beecher, Ill.—Bids will soon be asked for constructing a water works system.

Jellico, Tenn.—Voted to issue bonds for constructing a water works system.

Eastland, Tex.—The construction of a water works system is contemplated.

Prentice, Wis.—The question of installing water mains is being agitated.

Highland Park, Mich.—Voted to issue $31,000 bonds for water works extension.

Shiner, Tex.—Voted to issue bonds for the extension of the water works system.

East Alton, Ill.—The bd. of local impvts. has accepted plans for water works.

Ephraim, Utah.—Voted to issue bonds for constructing a municipal water works system.

Yacolt, Wash.—Voted to issue bonds for system.

New Holland, Pa.—Will vote in November on the construction of a water works system.

Fond du Lac, Wis.—The village of North Fond du Lac contemplates the purchase of a water works system.

Aberdeen, Wash.—Additional pumping facilities in South Aberdeen are contemplated. Supt. water dept.

Mobile, Ala.—A map for extensions to the water works and sewer systems has been completed.

Lynn, Mass.—A site has been selected on Walnut st., at Lyndhurst, for a mechanical filter plant.

Pittsfield, Mass.—The bd. of ald. has appropriated $24,000 for a permanent pump at Onota Lake.

Rogers, Tex.—Will vote Oct. 18 on the issue of bonds for installing a water works system. J. D. King, mayor.

Tecumseh, Neb.—The improvement of the water service and the construction of a concrete reservoir is contemplated.

Dewey, Okla.—Plans and specifications for constructing a new water works system have been submitted, but council has

decided that test wells should be put down before approving them.

Dunkirk, Ind.—Bids will be secured soon for constructing a water works system. Chas. Brossman, engr., Indianapolis.

Ballinger, Tex.—Will vote Oct. 16 on the issue of bonds for the extension of the water mains and other improvements.

Georgetown, Tex.—Will vote Oct. 17 on the issue of bonds for the purchase and improvement of the present water and light plant.

Urbana, O.—The citizens petitioned council to purchase the present water works plant for $100,660, or build a new municipal plant.

Denver, Colo.—This city voted to issue $8,000,000 for constructing a municipal water plant. John B. Hunter, ch. engr. B. P. W.

Owensboro, Ky.—The city council has appropriated $20,000 for constructing a water softening plant for the city water works.

Corning, Cal.—An ordinance has been adopted to issue bonds for constructing water works and sewerage systems. . F. E. Kenney, mayor.

Oriskany Falls, N. Y.—This village voted Sept. 6, to authorize the board of trustees to establish a gravity system of water works.

East Aurora, N. Y.—Voted to issue $18,000 bonds to extend the water mains and improve the pumping station. Vil. prest. Brotherhood.

Maxwell, N. M.—Special.—The Maxwell Irrigated Land Co. desires to purchase about 2.5 mis. of water pipe line, probably 6 or 8 ins.

Lordsburg, Cal.—Special.—A municipal water system will be installed at a cost of $36,000. Olmstead & Gillelen, engrs., Los Angeles.

Fairmount, W. Va.—Plans for constructing a water works system to supply water to the hilltop residents of this city are being prepared.

McLeansboro, Ill.—Plans and specifications have been submitted for a reservoir and water works system. The question will be voted on about Nov. 1.

Pittsburg, Kan.—Suit has been filed in the United States district court in Ft. Scott to enjoin this city from issuing bonds for building a new water works system.

Centerville, Mich.—Plans are being prepared for a new water works and electric light plant for the Centerville Water & Lgt. Co. F. W. Thomas, secy., 1919 Monroe st., Toledo, O.

Minneapolis, Minn.—The water works committee has recommended the purchase of 3 pumps, in accordance with the supplementary report submitted by E. B. Burch, hydraulic engineer.

Salt Lake City, Utah.—Geo. F. McGonagle, cy. engr., has plans prepared for constructing 19,000 ft. of 18-in. north branch water mains. The work will probably not begin until next spring.

Denison, Tex.—Special.—W. W. Berry, supt. water dept., says this city will vote on the issue of $50,000 water works bonds, Oct. 8, for constructing a pipe line and pumping station.

CONTRACTS TO BE LET.

Audubon, Ia.—Bids are asked until Oct. 3 for constructing a stand pipe. R. C. Spencer, mayor.

Oroville, Wash.—Bids are asked until Oct. 17 for constructing a water system. E. S. Taylor, town clk.

Alva, Okla.—Bids are asked until Oct. 4 for constructing a steel water tank. A K. Hubbard, cy. engr.

Ocheyedan, Ia.—Bids are asked until Oct. 5 for constructing a water works system. E. J. Parrott, cy. clk.

Decatur, Neb.—Bids are asked until Oct. 10 for constructing a water works system. Geo. F. Morley, cy. clk.

Victoria, B. C.—Bids are asked until Oct. 24 for brass goods, galvanized fittings, lead pipe, and galvanized iron pipe.

Tama, Ia.—Bids are asked until Oct. 3 for furnishing a centrifugal pump. C. A. Baughman, cons. engr., Ames, Ia.

Lakeland, Fla.—Bids are asked until Nov. 1 for improvements to the water and light plant. H. L. Swatte, cy. clk.

Oconomowoc, Wis.—Bids are asked until Oct. 3 for drilling a 16-in. well, 800 to 1,000 ft. deep. Clarence Schoemke, cy. clk.

Jacksonville, Fla.—Bids are asked until Oct. 4 for constructing a reinforced concrete reservoir. R. N. Ellis, supt. w. w.

Bradley, S. D.—Bids are asked until Oct. 5 for constructing a water works system. S. R. Caldwell, chm. bd. town trustees.

Cleveland Heights, O.—Bids are asked until Oct. 11 for constructing 8, 6 and 4-in. water mains in Noble road. H. H. Canfield, vil. clk.

Euclid, O.—Sealed bids are asked until Oct. 24 for constructing 12 and 16-in. water mains in Crosby ave. Nelson J. Brewer, vil. clk.

Tomah, Wis.—Bids are asked until Oct. 4 for constructing 3,700 ft. of 4-in. and 40 ft. of 6-in. c. i. water pipe and appurtenances. Cy. clk.

Chicago, Ill.—Bids are asked until Oct. 5 for constructing water service pipes in a large number of streets. Albert F. Keeney, prest. bd. local impvts.

Salt Lake City, Utah.—Sealed bids are asked until Oct. 7 for constructing 17,200 ft. of 18-in. and 500 ft. of 20-in. c. i. water main in City Creek Canyon. H. G. McMillen, chm. B. P. W.

Binghamton, N. Y.—Bids are asked until Nov. 1 for constructing a distribution reservoir, involving about 2,900 cu. yds. of plain and reinforced concrete. John D. Davidson, secy. bd. water comrs.

CONTRACTS AWARDED.

Chisholm, Minn.—The American Bridge Co. was awarded the contract for constructing 2 settling basins, for $14,000.

Conway, Ark.—The contract for constructing a water works system was awarded to Joseph McCoppin, of Little Rock, for $56,876.35.

Eveleth, Minn.—The contract for constructing new water pipes in central division No. 2 was awarded to Pastoret & Lawrence, of Duluth, for $9,000.

Hamburg, Ark.—The contract for constructing a water works and electric light plant has been awarded to W. J. Kennedy, of St. Louis, for $27,000.

Las Vegas, N. Mex.—M. M. Sundt has been awarded a contract for constructing an immense storage reservoir in the Peterson Canon, for $75,000 to $100,000, for the Aqua Pura Co.

Albany, N. Y.—The contract for constructing a reservoir and dam on the West Canada Creek at Hinckley was awarded to the Buffalo Dredging Co., of Buffalo, for $963,415.

Spokane, Wash.—The contract for constructing 79,500 ft. of kalamein pipe to be laid to Cannondale and Lidgerwood, was awarded to the Holly-Mason Hardware Co., for $59,445.

Port Clinton, O.—Special.—Bids for constructing a filtration plant were submitted Sept. 22, as follows: Norwood Engineering Co., Florence, Mass., $27,565; Roberts Filter Mfg. Co., $27,625; Doersbach Bros., Sandusky, O., $25,759; Pittsburg Filter Mfg. Co., Pittsburg, Pa., $26,500.

Pella, Ia.—Special.—A contract was awarded, Sept. 6, for constructing a combined water and light plant, as follows:

Des Moines Bridge and Iron Co., laying 18,500 feet of 10-in. pipe, $9,269; Des Moines Bridge and Iron Co., furnishing valves, hydrants and specals, $1,150; Des Moines Bridge and Iron Co., constructing filter gallery, well and pump house, $8,600; K. A. Verhey, constructing power house, $6,930; Des Moines Bridge and Iron Co., furnishing lead and jute, $1,500; Jos. E. Bortenlanger, Omaha, Neb., furnishing engines, boilers, generators, motors and all electrical apparatus, $21,652; Jos. E. Bortenlanger, furnishing two Triplex pumps, $3,590; Jos. E. Bortenlanger, 3½ miles transmission line, $3,750; Jos. E. Bortenlanger, city lighting lines complete, $10,152; Jos. E. Bortenlanger, secondary wiring, $3,500; U. S. Cast Iron Pipe and Foundry Co., pipe at $24 per ton, $15,625; total, $85,178. Murray Corliss engine, Ideal high speed engine, Murray boilers and Westinghouse generators and motors will be used. Iowa Engineering Co., Clinton, Iowa, engineers.

BRIDGES.

Salem, Ind.—Bids are asked until Oct. 3 for bridge repairs. Jos. W. Elrod, chm. co. comrs.

Rushville, Ind.—Bids are asked until Oct. 4 for constructing 3 bridges. J. N. Stone, co. audt.

Marion, Ind.—Bids are asked until Oct. 4 for constructing 8 concrete arches. A. Y. Stout, co. audt.

Lebanon, Ind.—Bids are asked until Oct. 9 for constructing 2 bridges. B. F. Herdrich, co. audt.

Philadelphia, Pa.—Bids are asked until Oct. 11 for constructing bridge, etc. W. Hunter, ch. engr.

Newport, Ind.—Bids are asked until Oct. 3 for constructing 2 bridges. H. T. Payne, co. audt.

Gothenburg, Neb.—Bids are asked until Oct. 8 for constructing a bridge across Platte river. Co. clk.

Washington, D. C.—Bids are asked until Oct. 3 for constructing several bridges. Thos. Nugent, co audt.

Petersburg, Ind.—Bids are asked until Oct. 4 for constructing 4 steel bridges. F. R. Bilderback, co. audt.

Greenfield, Ind.—Bids are asked until Oct. 3 for bridge repairs and construction work. C. H. Troy, co. audt.

Crown Point, Ind.—Bids are asked until Oct. 3 for constructing a bridge on Pulver road. C. A. Johnson, co. audt.

Waukesha, Wis.—Bids are asked until Oct. 3 for constructing a reinforced concrete girder bridge. M. R. Butler, cy. engr.

Martinsville, Ind.—Bids are asked until Oct. 6 for constructing 2 concrete arches. B. E. Thornburgh, co. audt.

Oswego, Kan.—Bids are asked until Oct. 3 for constructing 2 reinforced concrete arch bridges. W. A. Blair, co. clk.

Zanesville, O.—Bids are asked until Oct. 3 for constructing a bridge across Muskingum river at Fifth st. H. A. Buerhaus, co. audt.

Zanesville, O.—Bids are asked until Oct. 5 for constructing a concrete bridge on Cleague road. John F. Goldenbogen, clk. co. comrs.

Cincinnati, O.—Bids are asked until Oct. 14 for constructing a concrete bridge on Cleves and Warsaw pike. Stanley Struble, prest. co. comrs.

Shelbyville, Ind.—Bids are asked until Oct. 3 for constructing a concrete breakwater and a concrete steel culvert. G. B. Huntington, co. audt.

Winnipeg, Man.—Bids are asked until Oct. 8 for constructing a steel bridge about 1 mi. northeast of Cartwright. John B. Laughlin, clk. dept. pub. wks.

Allentown, Pa.—Bids are asked until Oct. 3 for constructing a steel girder bridge over Ontelaunee Creek, near Jacksonville. A. E. Bittner, chm. co. comrs.

Norristown, Pa.—Bids are asked until Oct. 11 for constructing a stone arch highway bridge over the northeast branch of Perkiomen Creek. Jas. Krewson, chm. co. comrs.

St. Joseph, Mo.—Bids are asked until Oct. 15 for constructing a viaduct or subway on S. Sixth st., across the railroad tracks of the Union Passenger Station in St. Joseph. Alfred Meier, prest. B. P. W.

STREET LIGHTING.

Marion, Ind.—The construction of a municipal light plant is contemplated.

St. Charles, Mich.—Voted to issue bonds for constructing an electric light and water plant.

Terre Haute, Ind.—An ordinance has been introduced for the establishment of a municipal electric light plant.

Binghamton, N. Y.—Will vote on the question of constructing a municipal lighting plant. John P. Irving, mayor.

Kansas City, Mo.—The Kansas City Missouri Gas Co. voted an appropriation of $400,000 to build an emergency gas tank.

Allentown, N. J.—Bids are asked until Oct. 10 for constructing a municipal electric lighting plant. A. Robinson, mayor.

Lakeland, Fla.—Bids are asked until Nov. 1 for extensions and improvements to the electric light and water plants. H. L. Swatts, cy. clk.

Missoula, Mont.—Bids are asked until Nov. 20 for constructing a power plant on Rock Creek at Stevensville. E. S. Dorman, ch. engr., Rock Creek Power Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Boston, Mass.—Bids are asked until Oct. 17 for disposal of refuse for 10 yrs. L. K. Rourke, supt. sts.

Jersey City, N. J.—Bids are asked until Oct. 10 for the removal of ashes, garbage and kitchen refuse for 1 yr. G. T. Bouton, clk. bd. st. and water comrs.

Kansas City, Kan.—A municipal incinerating plant for the disposal of garbage is urged by the Council of Clubs, which is composed of all the women's clubs in this city.

PARKS.

Palestine, Tex.—This city voted to issue bonds for the purchase of 2 parks.

Newaygo, Mich.—The site of the old court house will soon be converted into a city park, to be known as Brooks Park.

FIRE APPARATUS.

Rock Island, Ill.—The contract for installing a modern fire alarm system was awarded to Gamewell Fire Alarm Telegraph Co. of New York City for $11,256.

Hempstead, Tex.—W. P. Herms, B. Schwarz and others have been appointed a committee to purchase new fire equipment.

Waukegan, Ill.—Will vote Oct. 13 on issue of $35,000 bonds for erecting and equipping a new central fire station and a south side station.